Economics of the Australian Football League Draft

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Abstract

The Australian Football League (AFL) has utilised a draft system since 1986, to equitably allocate amateur talent amongst teams. Yet, given its complexity, many have questioned its usability from a team's perspective and its overall effectiveness in general. The overarching aim of this thesis is to develop an alternative model to value picks, players and future contracts within the AFL national player draft while analysing the effectiveness of the mechanism itself. To this effect, the first two studies proposed the use of post selection performance metrics to determine the value of draft picks, both in the current and future years whilst also equating them to value active players. This enabled the understanding behind the year-on-year performance of draftees in study three, which validated the request of teams to retain players for a longer period in order to recoup their investments. Instead of arbitrarily increasing contract lengths, the same study proposed the adoption of call options allowing teams to hedge against the upside potential in salary increases and guarantee players a reasonable package early on. Whilst these studies together provide the alternative model intended from this thesis, the second portion of its aim is to evaluate the draft itself in the absence of the former. Whilst the first two studies did show deviations between market and performance-based pick values, study four showed a draftee's post-selection performance remained in-line with the pick number used to select them, even when the picks were exchanged between teams prior to them being exercised. Yet, study five discovered a disparity in draftee retention if the pick used to select them was traded beforehand, as teams ride their investments into those picks driven by their misjudgement of value. This was made evident in the behaviour of teams intentionally losing games to obtain priority selections early on in the draft, as shown in study six. Hence, it is expected that through the adoption of the first part of this work, the league should be able to mitigate the behaviours portrayed in the second half. It is expected that this will provide information for teams to make decisions on picks and trades, and aid players to inform their personal interests and career prospects. Leading on, the thesis will extend the current knowledge by examining player performance in relation to draft pick allocation, together with overall team outcomes and examine the potential for the draft to create perverse incentives. Though this study examines these concepts in relation to the AFL, it is expected that the findings could be extrapolated in similar leagues.

Student Declaration

Declaration of Authenticity

"I, Jemuel Nilukshan Chandrakumaran, declare that the PhD thesis entitled "*Economics of the Australian Football League Draft*" is no more than 80,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work".

"I have conducted my research in alignment with the Australian Code for the Responsible Conduct of Research and Victoria University's Higher Degree by Research Policy and Procedures.

Signature: [redacted] Date: 24/10/2024

Ethics Declaration

"All research procedures reported in the thesis were approved by the Human Research Ethics Committee (HRE23-157)."

Signature: [redacted] Date: 24/10/2024

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DETAILS OF INCLUDED PAPERS: THESIS WITH PUBLICATION

Please list details of each scholarly publication and/or manuscript included in the thesis submission. Copies of published scholarly publications and/or manuscripts submitted and/or final draft manuscripts should also be included in the thesis submission.

This table must be incorporated in the thesis before the Table of Contents.

Chapter No.	Publication Title	Publication Status • Published • Accepted for publication • In revised and resubmit stage • Under review • Manuscript ready for submission	Publication Details • Citation, if published • Title, Journal, Date of acceptance letter and Corresponding editor's email address • Title, Journal, Date of submission
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4	Deferring draft picks: Empirical analysis of the AFL draft	Published	Chandrakumaran, J., Larkin, P., McIntosh, S. & Robertson, S. (2024). Deferring Draft Picks: Empirical analysis of the AFL draft. PLoS ONE, 19(9).
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List of Publications

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List of Abbreviations

AFL	Australian Football League
BMV	Brownlow Medal Votes
C/A	Club-Academy
CMV	Contribution to Margin of Victory
DVI	Draft Value Index
F/S	Father-Son
MLB	Major League Baseball
NBA	National Basketball Association
NFL	National Football League
NHL	National Hockey League
NRL	National Rugby League
PAS	Priority Access Selections
PVC	Pick Value Chart

Table of Contents

List of Figures

List of Tables

-To my dad-

Chapter 1: Introduction

1.1 Introduction

Competitive sport embodies the pinnacle of human physical excellence, where athletes push their limits in pursuit of victory, glory, and other forms of personal fulfilment. Whilst athletes play their part in the actual contest, an equal part is played by a loyal fan base united by their passion for athletic prowess, teamwork, and the thrill of competition. Their unwavering loyalty serves as the lifeblood of competitive sport, fuelling the excitement and energy that makes each game a spectacle to behold.

The popularity of competitive sport in the modern media landscape has driven the need for data collection across multiple avenues (such as on-field statistics, media ratings). They have, however, been given increased prominence with the sensationalisation of books such as Michael Lewis' *Moneyball* (2003), which showed the advantages a team could accrue by the utilisation of statistical methods. Lewis' narration of the 2002 Oakland Athletics' (a Major League Baseball (MLB) team) rise to fame from being an underrated club to a championship contender inspired the adoption of analytics (including machine learning and artificial learning) into multiple facets of sport, including economics, finance, marketing, psychology, and medicine (Castellano et al., 2011; Levin, 2009; Miguel et al., 2019).

Although the modernisation of data collection and relative statistical analysis to gain a competitive advantage over an opponent has rapidly emerged over the last few decades, its ability to get meaningful information into the hands of people who are in a position to make effective use of it still remains a challenge (Alamar & Mehrota, 2011). This is further exacerbated when validating theories regarding the overall competitiveness of a sport as the models in use are often developed independently to proven theoretical underpinnings.

The phrase 'tragedy of the commons' is commonly used in many academic schools of thought to portray a situation in a shared-resource system where agents act independently in their own self-interest against the common good. Hardin (1968) used the analogy of a herdsman to best describe this, stating that one wishing to increase his revenue would generally add more cattle to their flock. Whilst such self-centred additions might improve his top line in the short run, the increasing herd would inherently deplete the grazing pastures needed to sustain the herd and those of his competitors. To circumvent this adverse outcome, some form of collective (or government) intervention is required (Ostrom et al., 1999).

Rottenberg (1956) applied this theory first within the sporting arena and surmised that ‘no team can be successful unless its competitors also survive and prosper’ (p.254). Should the market for talent be left unrestricted, wealthier teams will continue to acquire the best players, by outbidding their competitors and deplete the common resource. This in turn will create a cascading effect by reducing the uncertainty of match outcomes and ultimately diminish spectator appeal due to the lack of an even competition (Borland & Macdonald, 2003; Forrest & Simmons, 2002; Fuller & Stewart, 1996).[1] Ideally, a league would like ‘every “well-run” club to have a regularly recurring reasonable hope of reaching postseason play’ (Levin et al., 2000, p. 5).

In response to this, many professional sporting leagues (especially closed leagues with no promotion and relegation) have introduced various policies such as revenue sharing (including financial fair play regulations in European soccer to prevent clubs from overspending), salary caps and player drafts to induce a balance amongst all the clubs. A list of tools have also been developed to verify the effectiveness of such competitive balance policies (Evans, 2014). These commonly look at the concentration of wins amongst all the teams within a specific league and the dominance of a select few. Ideally, a competitive league ought to have an evenly distributed win-loss spectrum in order to encourage fan involvement. However, the effects of the policies may not always produce the intended outcome of an even competition. For example, studies have shown the salary cap within the National Football League (NFL) may be ineffective (Boulier et al., 2010; Fort & Quirk, 1995; Larsen et al., 2006), while the draft may also have failed to achieve

[1] Alternatively, emerging literature has also proposed other ideas of driving customer demand which might not reconcile to the uncertainty of outcomes hypothesis (Johnson & Fort, 2022).

its goals in other North American competitions (Berri & Simmons, 2011; Fort & Lee, 2007; Reynolds et al., 2015).

1.2 The AFL Draft

The Australian Football League (AFL) is one such sporting league operating as a closed league competition with no promotion or relegation as those commonly observed in most association soccer leagues. The origins of Australian Rules football can be traced back to the first half of the nineteenth century when military personnel engaged in the sport as a wartime amusement. After the establishment of the Melbourne Football Club, the rules of the sport were formalised based on Gaelic football with a soccer-like set-up (Hess et al., 2008). With the incorporation of the Victorian Football League in 1896, and the subsequent expansion to the other states rebranding it to the AFL in 1990, it remains the most popular sporting league in Australia (Kwek, 2013). Throughout the last two centuries, the league has promoted a cohort of equalisation policies, to ensure the sport remains competitive and prevent the continued dominance of a few wealthy teams (Booth, 2004, 2005). One such policy is the national player draft introduced in 1986. Unlike its predecessor from 1981, the new draft allowed teams to recruit players from all over the country. The selection order mimicked those of North American reverse order drafts, whereby the team that finished last in the season immediately before the draft chose first, followed by the second last, until all teams have done so in a round. Currently, this process is repeated approximately four times. Although the draft is not the only way by which clubs recruit players, it remains one of the league's primary and effective competitive balance policies (Booth, 2004). Whilst the draft was instituted with the intent of cyclically altering the fortunes of the teams involved in the league over time, various other competitive balance policies built into it, such as trading picks, has diluted it from a pure reverse order system to a more complex venture. As a labour market intervention technique, the draft provides teams the opportunity to source amateur talent in line with future expectations and also trade picks to suit their requirements. This provides numerous opportunities for an academic investigation of the draft to evaluate its effectiveness, and the manner in which it's been used by the relevant stakeholders whilst providing guidance in suitable exchange systems.

1.3 Research Purpose

A common thread observed across player drafts and its utility amongst other sporting codes is the misconception of pick value (Massey & Thaler, 2013). This leads to irrational behaviours such as decision makers retaining draftees to justify their investments (Staw & Hoang, 1995), or even intentionally losing games to accumulate early draft picks (Fornwagner, 2018). Whilst the AFL player draft has been touted to induce a level of competition within the league (Masson et al., 2014), the same concerns with regards to its use still exist.

If we assume each pick (or selection) in the player draft is an asset, the value inferred on it by various players in the market (i.e., teams, players, agents, and the league) dictate the way in which they would be both exchanged and utilised. According to the efficient market hypothesis (EMH), all asset prices should fully reflect the available information in the market. Should this theory hold, no agent can consistently achieve above market yields (Fama, 1998). Whilst the theory has primarily been used to predict performance and evaluate the rationality of financial markets, lately, it has also been utilised in sports related research. When this is retrofitted to the specific nature of the player draft, the first obvious step would be to create a denomination to value each pick in the draft. This should both facilitate pick-to-pick exchanges, but also those in future years and pick-for-player trades.

Once a clear determination of value has been established, the next step would be to understand a team's perceived utility of any selections they exercise within the draft. Currently, the AFL requires all draftees to sign contracts for two years with the team that initially drafted them into the league (AFL, 2017). However, these two years might not necessarily provide teams with the utility expected to improve their overall position based on their inferred value of the pick used to select the player. Hence, a proper mechanism ought to be proposed where teams could retain players to draw out the best utility to at least break even their investment, without impeding on a player's ability to capitalise on the transfer market.

The next step would be to understand the manner in which teams have used the draft till now, against the benchmarks of pick value and perceived utility that have been established earlier. For example, the retainment of players recruited through picks that have been traded or exchanged versus their on-field performance. Ideally, as long as the transaction cost of an exchange remains low, the outcomes expected from a player ought to be the same as a player recruited through a non-traded pick (Coase, 1960). If this holds true, teams should not hold the player drafted using a traded pick longer than a draftee from a regular selection.

Another unfavourable consequence of the reverse order system is it tempts teams to lower themselves on the season standing in order to get access to early draft picks. Whilst this is mainly caused by a team's misunderstanding of pick value and the perceived impact a single player might have on the outcome of a game (Lenten et al., 2018), such behaviours run contrary to both the purpose of the draft and the spirit of the game. Melbourne Football Club's behaviour in the 2009 season served as an infamous local example of this phenomenon (Pierik, 2012). With only three wins by round 18, Richmond beat Melbourne by four points, even when they trailed them into the final quarter. The media hinted the abrupt positional changes that could have handed Richmond the win. Though the team was never charged, key personnel were found guilty of related charges. It was presumed that they were aiming for a priority pick in the draft immediately after that season. Ideally, a team's chances of winning any game should be a factor of their relative strength compared to the opposition.

By conducting an evaluation of the AFL player draft, this thesis will contribute to the prevailing body of knowledge and further extend the understanding behind the efficiency of the league's competitive balance procedures. This will be complemented by testing relevant economic theories under the EMH umbrella using an ontological inquisition of quantitative data. Furthermore, this thesis also provides both the league and teams with a more common denomination to exchange picks and players, with provisions for multi-year trades. In addition to this, it is expected the thesis will promote a mechanism for teams to extend the initial contracts of players with mutually beneficial terms. The findings could also have a significant impact on how the league structures the draft and how the teams utilise it.

1.4 Research Aim & Objectives

The overarching aim of this thesis is to develop an alternative model to value picks, players, and future contracts within the AFL national player draft, while analysing the effectiveness of the mechanism itself. To that end, the thesis aims to address the following applied research objectives, which will be evaluated using economic principles across the six studies introduced within this thesis:

1. Develop a model to evaluate both active players and draft picks using the same metric, so trades across both asset classes can be facilitated – Chapter 3
2. Assess the potential for a discount rate system by which teams could differ the tentative returns of future draft picks in analysing trades involving the same – Chapter 4
3. Propose a system by which a draftee's initial contract can be extended, without impeding on their ability to capitalize further economically – Chapter 5
4. Evaluate the pick trading market and gauge post-draft performance of players recruited utilizing traded picks – Chapter 6
5. Examine the trading market to assess if players chosen via traded picks are subject to any endowment effects – Chapter 7
6. Evaluate the draft for its potential to create perverse incentives encouraging teams to intentionally lose end of season games – Chapter 8

1.5 Structure of the Thesis

This thesis is structured as follows. Chapter 2 provides a thorough review of the theoretical and empirical literature. Chapters 3 through to 8 provide published papers for each of the individual objectives listed earlier. The thesis concludes with Chapter 9 that discusses the individual studies within the context of this thesis' aim and the implications of the findings.

Chapter 2: Literature Review

2.1 The Player Draft

Player drafts are labour market intervention techniques commonly used in closed sporting leagues (competitions with one league unlike open tournaments, where teams are promoted and relegated within divisions) around the world. The first player draft was introduced back in 1935 within the NFL (Maxcy, 2012) with a reverse order system of selection. Thereby, a team finishing last in any given season, would have the first overall pick in the forthcoming draft, followed by the second last, until all teams have finished a complete round of selections (known as a round). This process is repeated seven times in the current NFL draft. In following this process, the draft aims to distribute amateur talent in an equitable fashion as the worst performing team might have priority access to the amateur talent pool allowing them to bolster their future prospects and cyclically alter their fortunes (Tuck & Richards, 2019). That is, assuming teams choose the best draftee available with each pick, the club which finished last overall, will have chosen the best players which may increase their chances of winning in the upcoming seasons. Furthermore, as teams are required to select players sequentially, the draft inadvertently discourages expensive bidding wars, like those observed in the veteran player market, which prices out teams with smaller salary budgets. Owing to its success, other sporting leagues have also incorporated the player draft into their suit of measures, such as the National Basketball Association (NBA) in 1947, the National Hockey League (NHL) in 1963 and Major League Baseball (MLB) in 1965, with minor changes in the order of selection. However, studies have suggested these drafts have not achieved the perceived balance the leagues have yearned for by introducing them (Berri & Simmons, 2011; Fort & Lee, 2007; Reynolds et al., 2015) as the dominance exerted by a niche group of teams remained unchallenged. Given the relatively larger salary caps observed in North American leagues, high profile franchises have been known to outspend their counterparts in the free agency market circumventing the draft rules.

The player draft was first introduced in the AFL in 1981. However, since it only allowed teams to draft players based on a predefined zone, it was immediately scrapped the following year. The current draft format was reintroduced by the league in 1986, allowing teams to recruit players from anywhere in the country in a reverse order system similar to its North American counterparts. However, the AFL player draft allows teams to recruit both amateur players and veteran players without a contract, whereas the North American drafts is restricted to first time recruits. Although the draft is not the only way by which clubs recruit players, it remains one of the league's primary and effective competitive balance measures (Booth, 2004, 2005). Whilst the draft was instituted with the intent of cyclically altering the fortunes of the teams involved in the league over time, various other competitive balance policies built into it, has diluted it from a pure reverse order system to a more complex venture. Through this thesis we aim to evaluate the impact of such provisions and provide alternative suggestions to accommodate the prevailing gaps.

2.2 Pick Trading

The league has always allowed teams to trade the picks they are allocated in each year's draft for both active players in a team's list and other picks, or a combination of both. This has allowed teams to navigate the draft and to use it in an efficient manner by positioning themselves based on their own requirements. For example, a team with the first pick in the draft (assuming it was the least performing team in the last season), might not necessarily use the pick as it already holds a good number of players in its list. Instead, another team might have a requirement for this pick as it might use it to select an important amateur, who could be contested for by another club. In such a situation, the team holding the first pick could trade their pick to go down in the draft order and amass a selection of picks or players from the team trading up.

From 2015, the league extended this provision where by teams can also trade for picks up to one year in to the future ((Bowen, 2015); to be increased to two years in 2025 (Twomey, 2024a)). The inclusion of this provision further allows teams to leverage their future prospects seeking immediate returns. Similar to the earlier example, a team wishing to trade up the draft order could not only forgo players and picks in the current year, but further entice the other club using its picks from the future as well. This creates three major issues; [1] what is the value of each pick in the AFL draft? [2] how can potential draftees be equated with active players to find a common denomination when trading between these two classes? and [3] what is the discount rate that ought to be applied to future picks? These questions are routinely considered by all teams when making trading decisions, to both ensure an opportunity exists for a trade and maintain fairness and equity with each negotiation.

2.2.1 Pick value

Based on the dynamics of the draft discussed before, the trading of picks between teams calls for a unanimous pick value function that is accepted by all. Unlike a conventional market environment where buyers and sellers exchange goods and services for a consideration known as cash, trades in the draft market can only be compensated by picks and players. As these are indivisible assets, picks and players ought to be denominated into a common currency that will allow both the evaluation and execution of such trades. This section will examine the alternative functions available, and discuss the perceived inefficiencies, both in the existing body of knowledge and the industry.

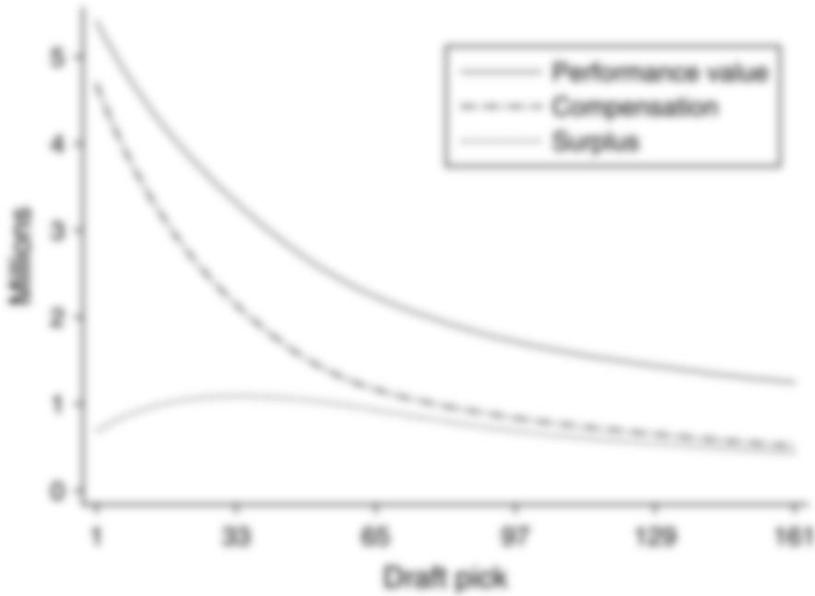
2.2.1.1 Pick Value Chart

The first known pick value chart (PVC) was created by Mike McCoy and Jim Johnson of the Dallas Cowboys (an NFL club) in the late 1980s' so that they could ascertain the value imparted by teams for each pick in the market. The authors analysed draft day pick trades over a ten-year period and predicted the market value of each selection in the NFL draft (Maxcy, 2012). The PVC assigned a numerical value to each pick in the NFL draft starting with the first pick worth 3,000 points, declining similar to a conventional production function (which declines at a lognormal rate). Though the PVC is not officially endorsed by the league, most teams in the NFL have used it as a guide in their trade negotiations. For example, a team with the first pick wishing to go down the draft might trade it for picks 7, 16 and 40 which collectively equate to 3,000 points (1,500+1,000+500).

Massey and Thaler (2013) evaluated this by analysing draft day trades in the NFL across two decades. They used a Weibull distribution function to equate all trades, so the earliest pick in each exchange was equal in value to the net of the remaining picks. For example, if team A got picks 1 and 15 from team B in lieu of picks 5, 6, 10, 20 and 50, the model assumed the value of pick 1 to be equal to the sum of picks 5, 6, 10, 20 and 50 minus pick

15. Their findings supported the previous PVC, showing its apparent acceptance across the league as a depicter of market value. However, the authors questioned the validity and efficiency of the PVC and the NFL draft pick market overall. Apprentices are usually compensated at levels which are inconsistent with their performance levels (Gambin et al., 2010). This is made evident in Figure 2.1 where the compensation of a draftee is relatively lesser than the performance output gained through them on field (the compensation of a veteran NFL player at the same performance level). The surplus value (performance value minus compensation) per pick was much lower for earlier picks compared to the latter. This allowed them to conclude that decision-makers in the NFL were overconfident in evaluating potential draftees, which resulted in them overvaluing early picks (by paying more). This phenomenon inadvertently created an arbitrage opportunity for teams willing to trade down (which is against conventional wisdom) as the surplus value was actually higher between picks 25 and 40. That is, whilst the draft is predestined to allow teams to choose the best player early on, the shift in surplus value would give teams with the 33rd pick more in return in terms of value for money. This highlights the need for alternative indices to value draft picks as the market value system detracts from the purpose of the draft. Ideally pick value should retrospectively represent the expected performance of draftees and not what prospective suitors would be willing to exchange for them.

Figure 2.1: Surplus value by draft order (Source: Massey and Thaler (2013))



2.2.1.2 AFL Draft Value Index

Similar to the example cited earlier from the NFL, the AFL has a league endorsed pick value system which was introduced in 2015. However, unlike the NFL, the purpose of this system was not to evaluate trades (though it is also possible), but rather to manage a set of rules unique to the AFL. The AFL has two priority access selections (PAS) embedded into the draft design. The Father-Son (F/S) rule essentially gives teams the choice of recruiting the sons of former players, which portrays the AFL as a family-oriented legacy affair for a nostalgic effect (Tuck, 2015). The rules concerning the eligibility of players has been revised multiple times with the current system requiring the father to have played a minimum of 100 games for the club considering recruiting the son. From 1997, the league decided to incorporate the execution of this rule through the draft, causing teams to effectively pay a price (using a pick). Till 2007, any team that exercised this rule only had to relinquish a third-round pick from that year's draft. For example, in the 2003 draft, Melbourne wished to recruit Chris Johnson, son of former player Alan Johnson. The team eventually nominated Johnson using pick 36, which was their first available third-round pick at the time. However, the league was concerned these selections did not accurately represent the value of the player as teams could potentially recruit a high performing athlete with a pick promising less returns. So, in 2007, the league revised the rules requiring teams to use a pick in the same round where a competing bid for the player is made by another team. Referring back to the previous example, let's assume Johnson was enticed by another club, say Western Bulldogs, who were willing to recruit him in the same year with pick 1, which is in the first round. In order to recruit Johnson, Melbourne would need to use their next available pick in the first round, which was pick 3. This bid matching revision allowed for the pick used to represent the market appreciation of the player, unlike the pre 2007 system (Stewart et al., 2016).

The second PAS practised in the league is known as the club-academy (C/A) rule. Proposed in 2010, the rule revised the existing scholarship system that allowed the four northern clubs (Brisbane, Gold Coast, Sydney, and Greater Western Sydney) to set up and train junior footballers. The purpose of the rule was to promote Australian Rules football in the rugby league dominated areas of Australia and provide amateurs a pathway into the sport within their hometowns. It also provided the clubs that ran these academies priority access (not exclusive) to amateurs who graduate from them through the draft. In 2015, the league extended this privilege to all teams (AFL, 2015b) allowing them to create academies in specific zones as determined by the league. However, this privilege is restricted towards amateurs with Indigenous backgrounds whereas the northern clubs can promote amateurs from any background. This inclusion also makes them eligible to draft rookies from their own academies. As a PAS, the C/A system also follows the same rules as F/S in terms of its execution. Since it was created in 2011, the 2007 F/S rules applied to C/A as a team had to use the pick in the same round where a competing bid for the player is made by another team.

Whilst the 2007 rule revision attempts to minimise the impact between a competing bid and the actual pick used to select a PAS player, it still did not fully represent the value of the player as the team exercising the PAS rule had a slight advantage. If Johnson, was contested by the Bulldogs at pick 1, but selected by Melbourne at pick 3, there is still a single point pick difference. The main issue faced in both scenarios was the indivisibility of draft picks, similar to the failure of the barter system. Even if clubs that exercised PAS wanted to compensate teams with counter bids, there was no standard measure to equate lost value. To circumvent this issue, the AFL introduced the Draft Value Index (DVI) in 2015 (as shown in Figure 2.2).

Figure 2.2: AFL DVI Graph (Source: AFL (2015a))

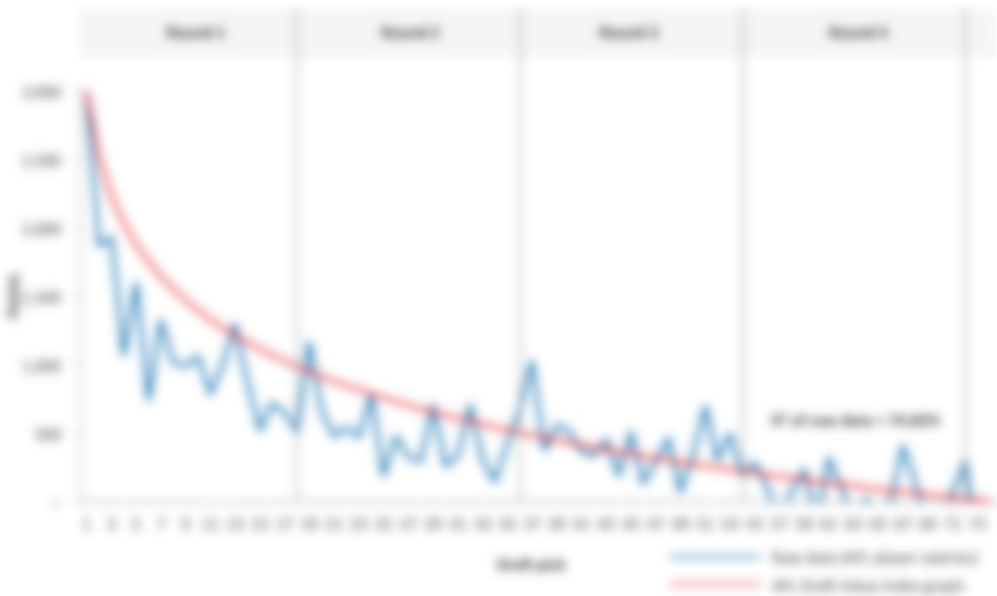


Table 2.1: AFL DVI (Source: AFL (2015a))

[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

The new index was created by retrofitting career wages paid to draftees selected between 2000 and 2014 (AFL, 2015a). In doing so, teams wishing to exercise PAS could equitably compensate other clubs by relinquishing draft picks of equivalent value to the competing bid (the current DVI allocates a numerical value for each pick till 73, however, the proposed revision in 2025 will stop at pick 54 (Twomey, 2024a)). As in the previous example, if Johnson was contested by the Bulldogs at pick 1, Melbourne can still invoke the F/S rule to pick him. However, in the new system, Melbourne would need to compensate the league with the DVI points of pick 1 instead. As per Table 2.1, pick 1 is worth 3,000. The rules stipulate that teams can claim a 20% discount (to be reduced to 10% in the 2025 revision) on the value of a matching bid in the first round (only the first 18 picks get the 20% discount, whilst any other pick would get a 197-point discount, which is the discount value of the 18th pick). So, the total amount which Melbourne ought to relinquish rounds to 2,400 (3,000 x (1-20%)). Given the third pick is valued at 2,234 points, Melbourne still needs to cover a deficit of 166 points (2,400 – 2,234). This will be recuperated from the team's next available pick, which was pick 5. As pick 5 is worth 1,878, after 166 is taken off of it, Melbourne would be given pick 6 (worth 1,751) instead.

In summary, Johnson would be picked at pick 1, the previous owners of picks 1 and 2 would drop to 2 and 3. Moreover, Melbourne's pick 5 would be replaced by pick 6 and the previous owner of pick 6 would obtain pick 5 (refer to Table 2.2). This way Johnson would be selected at the current pick, and all the teams impacted by invoking the PAS rule would be equitably compensated.

Overall, the aim of the DVI would be achieved here in terms of making sure teams bidding for PAS pay something close to the market value of the picks. However, the choice of career player wages as the dependant variable questioned the validity of the index (Chandrakumaran, Stewart, et al., 2023). The AFL DVI and the NFL PVC follow a similar trajectory (refer to Figures 2.1 and 2.2), making it logical to presume the same mismatch between salaries and performance observed in the NFL (Massey & Thaler, 2013).

Table 2.2: Comparison between the execution of PAS rules

1997 Rule			2007 Rule			2015 Rule		
Pick	**Team**	**Player**	**Pick**	**Team**	**Player**	**Pick**	**Team**	**Player**
1	Western Bulldogs		1	Western Bulldogs		1	Melbourne	Chris Johnson
2	Carlton		2	Carlton		2	Western Bulldogs	
3	Melbourne		3	Melbourne	Chris Johnson	3	Carlton	
4	Western Bulldogs		4	Western Bulldogs		4	Western Bulldogs	
5	Melbourne		5	Melbourne		5	Essendon	
6	Essendon		6	Essendon		6	Melbourne	
…			…			…		
36	Melbourne	Chris Johnson	36	Melbourne		36	Melbourne	

2.2.1.3 Wages in Sport

As the AFL DVI is based on player compensation it is important to understand the theories on how wages are determined. In labour economics, wage determination concepts can be broadly divided into two branches, namely efficiency wage and tournament theory. Firstly, the efficiency wage model suggests employers compensate employees based on their marginal output of labour units (Marshall, 1997). In simple terms, managers will be indifferent to employees with the same productive output. The model inherently discouraged the potential for employee 'shirking' where workers inflate non-productive outputs (Shapiro & Stiglitz, 1984). The major counter argument for this model was that it required employers to continuously pay their employees above the clearing rate (or market rate) in order to sustain worker productivity and discipline (Akerlof & Yellen, 1990; Raff & Summers, 1987).

The second concept in wage determination is the tournament theory which suggests remuneration mismatches based on subjective differences between individuals (Lazear & Rosen, 1981). Contrary to the efficiency wage model, tournament theory suggests workers be paid based on their rank within a firm. Essentially this motivates a behaviour of 'reaching the top' within organizations, where compensation is linked to both skill and sometimes chance. Experts usually refer to the 'next in line' example to articulate this theory. In the event of a demise or impairment of a president of a country, the vice president is placed in their stead. In such situations, though the output of the incumbent does not suddenly increase, their wages does increase to reflect the position they now hold.

In the professional sporting world, athlete compensation is determined by a variety of factors other than marginal productivity. Though, Papps (2010) suggested the use of efficiency wage model creates long-term player motivation. Essentially a player who consistently performs would be compensated fairly. However, many others have put forward the use of tournament incentives to motivate low-paid athletes (Rosen, 1986; Simmons & Berri, 2011). In such scenarios, players are paid based on their standing in the team, like the positions they hold and their off-field contributions in coveting endorsements. Due to this, compensation in the sporting world reflects the athlete's experience (Blass, 1992), and star power (Adler, 1985; Ahlburg & Dworkin, 1991; Berri et al., 2015; Berri et al., 2004). On the other hand, teams within leagues that operate a salary cap will have to optimize their allocation to both retaining high paid veterans and recruit new players, causing the size and budgetary constraints of a team to be a deciding factor for pay deals (Idson & Kahane, 2004; Kahane, 2001). Moreover, whilst studies have shown a mismatch between post draft outcomes and salaries paid to draftees (Chandrakumaran, Stewart, et al., 2023; Massey & Thaler, 2013), one could question the choice of wages as a determinant of pick value, especially when salaries return to the same levels after a few years irrespective of pick, as shown by Keefer (2016) in the NFL. Hence, any draft pick valuation system should be based on an objective performance measure instead, as they can more accurately measure match-to-match performance. In the AFL, players recruited through the draft ought to be paid a consistent amount based on the round of their selection (AFL, 2017), which isn't a true representation of collective team performance. After the initial contract period, players can negotiate their packages, which is again restricted by the team's own player salary caps. However, match-to-match performance can more accurately equate for the variance in player performance across time, whereas player salary is a longitudinal projection of expected performance.

2.2.1.4 Player Performance

It is evident that any pick value function cannot use compensation as a determinant due to the non-performance related incentives involved in its creation. So, it is safe to suggest that any pick value function ought to follow the performance value that could be extracted from a player, as it directly relates to match outcomes.

Player performance can be mainly classified into two main timelines (pre (or amateur) and post professional phase). The first being pre-professional or amateur metrics. Studies have suggested the use of physical and anthropometric parameters in the amateur level to predict future performance (Robertson et al., 2015; Woods et al., 2015). Especially, in leagues where drafts are used to select amateur players, the competitions usually host an event called the draft combine where such metrics are collected and evaluated. For example, the previous studies have suggested the use of vertical jumps and sprints as predictors of success and have the potential to identify talent in Australian football.

However, studies have questioned the validity of these events, as they might not be able to predict the future performance of such players in the professional league. Instead, these tests can only determine the points at which decision makers might select them in the draft (Gogos et al., 2020; Kuzmits & Adams, 2008; McGee & Burkett, 2003; Robins, 2010).

Therefore, the prevailing literature favours post selection player performance due to its utility in not only determining value, but also developing game day strategies (Al-Shboul et al., 2017; Tavana et al., 2003; Trninić et al., 2008). The first of such metrics relates to the outcome indices such as games played or started and even time-on-field. The use of such metrics by themselves have been discouraged, as there might be other subjective factors influencing the decision-makers. These include, but are not limited to, injuries within team lists, opposition analysis and game day strategy. Hence a player's time on field might not always represent their ability but the necessity of the team to utilise them on certain situations.

Ideally player performance ought to represent their contribution to the team's overall chances of winning a game. To that effect much academic work has been developed in continuous invasion type sports around the world. These include, Cooper et al. (2009) and Casals and Martinez (2013) who developed a methodology to weigh performance factors relative to their importance for each position within basketball, and Woods et al. (2017) who clustered the overall statistics of a team to determine the end of season ladder position in rugby. Similarly, player movement variables in relation to the team has also been used as determinants to ascertain individual performance (Castellano et al., 2011; Hiscock et al., 2012). On the other hand, a player's contribution has been looked at through the lens of their presence in the game, primarily in basketball, as a means of validating their importance (Casals & Martinez, 2013; Kharrat et al., 2020). Alternatively, the existing literature also provides evidence of player rating systems that were developed by identifying complex patterns amongst teammates in various sporting competitions (Duch et al., 2010; McHale et al., 2012; Thomas et al., 2013).

The first study within the AFL, used regression models to identify 11 key on field metrics that were important to determine the margin of victory in a game (Stewart et al., 2007). This paper paved the way for many similar exercises within the context of the AFL, where on field player statistics have been used to predict match outcomes (Cust et al., 2019; Robertson, Back, et al., 2016; Robertson, Gupta, et al., 2016), generate quasi player rating models (Sargent & Bedford, 2010, 2013) or inversely determine the best predictors of individual performance (Woods et al., 2015). Collectively all these studies concluded on the significance of certain on field metrics such as marks, kick, handballs and possessions or a series of such metrics in attainting match winning/scoring outcomes. It is also important to note that commercial player ratings systems are also in place in the AFL in the likes of Champion Data (CD) ratings. This is a proprietary method of objectively evaluating player performance by assigning values to a range of on field statistics (similar to the studies cited earlier) developed by Champion Data in conjunction with the Swinburne University school of mathematics. Whilst these works have laid the foundation for the assessment of performance in continuous invasion sports like Australian football, it is reasonable to require any pick value system to be based out of post selection performance outcomes. This will designate a perceived expectation on those recruited at various points of the draft, effectively creating a pick value denomination that could be used to evaluate trades across picks and players.

2.2.1.5 Alternative Indices

As discussed earlier, due to the mismatch in market inefficiency within the NFL PVC, it is important to understand the actual value of a pick based on the expected performance to be derived off a recruit. Currently multiple studies have been undertaken to provide alternative methods of pick valuation in the fields of statistics and operations research. Dawson and Magee (2001) used an isotonic regression to develop an index within the National Hockey League (NHL). They used games played as a measure of performance and estimated the effect of player position, drafting year and pick number had on it. Upon estimating the model, they plotted a pick value function that concluded any future pick value function would be both inverse and monotonic (remain decreasing if inverse). Conlin and Emerson (2005) expanded on this within the NFL, using games started and active contract lengths, controlling for a cohort of other independent factors such as race, age, and position played etc., concluding likewise showing a mismatch between the PVC and the new index. Shuckers used games started (2011a) and time on ice (2011b) within the NFL and NHL and plotted them against draft picks only using a locally weighted polynomial model (LOWESS). Under both scenarios, the author observed a less significant decline in value reinforcing the statistical mismatch between the market value of a pick as dictated by the PVC and expected performance. Similar findings were replicated by Hurley et al. (2012) who used survival analysis within the NFL and NHL. Here the authors used time taken by draftees to play a predefined number of games across both leagues and used pick number as the sole determinant. The value function from the NFL concurred with the previous studies cited earlier, though there was much variation observed in the NHL. This was attributed to the deviation in age of recruits in the NHL.

Similar studies have been undertaken in the AFL as well. Glasson and Bedford (2009) observed the career survivability of players selected at various points through the draft. They also used a survival model to map out the time taken (measured by number of games played) by draftees to be either delisted or retire. The findings suggested a monotonic decline similar to the studies in the North American leagues, but warranted further analysis as the determinant variable in the study was confined to only pick number. O'Shaughnessy (2010) used extreme value theory to create a value function in the AFL to model the ability of draftees to achieve a set number games/seasons in their career, yielding similar results as the previous authors. Mitchell et al. (2011) and Stewart et al. (2016) utilised games played and CD ratings as alternative measures of performance. Using a simple linear regression, both studies retrofitted pick value controlling for other variables such as race, age, team etc. Their findings also suggested an inverse monotonic function that declines at a much lower rate when compared to the AFL DVI.

Overall, the common denominator in all the prevailing alternatives is the proposed models decreased at a lower rate than the exponential decline observed in both the PVC and DVI. While these alternatives allow teams to define a common denomination for the valuation of picks which facilitates the trading of the same, they fail to address matching future picks and cross asset dealing when these bargains include active players, who are evaluated using different metrics.

2.2.2 Future Value of a Pick

Since the AFL allows trading of draft picks up to one year into the future ((Bowen, 2015) – to be extended to two in 2025 (Twomey, 2024a)), the question remains as to how the time delay should be factored into trade negotiations. For example, in 2015 Brisbane traded their third-round pick from the 2016 draft to Geelong in lieu of Josh Walker and Jarrad Jansen. This allowed Brisbane to utilize both Walker and Jansen in their next season, while Gelong needed to wait an additional year to cash the pick to select an amateur player.

In the financial world, decision makers who evaluate investment prospects over multiple years, usually discount the expected payoffs using the cost of capital to arrive at the present value. However, in situations such as this where non-monetary returns are involved, an implied rate is used to assess these payoffs (Kim & Haab, 2009; West et al., 2003). Teams choosing to advance up the draft order in the current year have been known to trade heavily discounted future picks (Massey & Thaler, 2013), owing to clubs favouring current year picks (and by extension, access to high quality recruits) to deliver immediate results (Taylor et al., 2018). Though these demonstrate subjective traits affecting the decision-making process, there is a genuine vacancy in the literature to understand what the actual discount rate ought to be.

In summary, whilst pick trading is proven to be an effective measure to facilitate need based talent identification through the draft, it is equally important to ensure a common denomination is used to evaluate such trades. The AFL's DVI aims to facilitate this exchange, however, its use of player compensation as a determinant of value detracts from representing the expected outcomes of selecting players through the draft. On the other hand, the alternative indices discussed in the literature handles this by introducing pick value mechanisms based on expected performance instead. Still, the question remains on how picks from future years ought to be valued (or discounted) in present year terms, whilst equating draft picks and active players also remains unanswered.

2.3 Training & Draftee Contracts

The cost of training amateur talent to a desired level of proficiency is a costly undertaking taken up by most employers requiring specific skillsets. However, the most commonly asked question is, who pays the bill? In a conventional work environment, firms might hire a rookie under a constant wage deal and simultaneously invest in their training. During this time, it is expected the rookie will cause a net loss for the firm as their marginal cost outweighs the revenue they generate (Becker, 1994; Gambin et al., 2010). Though trainees do turn this around, employers will tend to restrict the ability for such employees to move until such time as they could recoup the net loss using stricter contracts (Dockery et al., 1997; von Bergen & Mawer, 2007).

Similarly, in the sporting world, irrespective of previous experience in the minor leagues, rookies selected to play in the professional leagues generally undergo a rigorous training regimen. Hence, they might also yield lower outcomes in their early career similar to conventional employees. And just like regular firms, teams have been known to extend contract lengths or restrict player movement in the initial contract period in order to recoup their investments (Daymont, 1975; Krautmann et al., 2000). As the player draft usually assigns amateur players to professional clubs with binding contracts similar to those expressed earlier, they have also been known to create a monopsony market for talent (Dabscheck, 2004). Moreover, some leagues, such as the NFL (which has a four-year initial contract period) allows clubs to have the option of extending the contract by an additional year at their discretion. This has sparked multiple labour actions in the past including a successful legal challenge[2] in the National Rugby League (NRL, the premier rugby league competition in Australia), where the court ruled the draft, [1] limited the freedom of a player to select his employer,[3] and [2] imposed a new post-contractual restraint upon him.[4]

Within the AFL, however, the initial contract period for a player selected through the draft is capped at two years (to be increased to three years for those selected in the first

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[2] *Adamson v New South Wales Rugby League Ltd* (1991) 31 FCR 535, 268
[3] Ibid, 280
[4] Ibid, 281

round of the draft from 2025 (AFL, 2024)). Due to this, clubs have lobbied for the contract length to be increased by one year, as the initial two seasons do not allow teams to fully recoup their investments (Twomey, 2024b; Twomey & Cleary, 2021). The driving force behind this call has been the exponential earnings secured by draftees from their third season, after the expiry of their initial contracts. As the AFL is an Australian league similar to the NRL, the proposed change could violate the legal precedent posing as an additional post contractual constraint. This raises an ideal opportunity to propose an alternative which protects both the interests of the club and the player.

2.4 Efficient Market Hypothesis

As advised in the introductory section, the EMH aims to ensure that all available information is taken into consideration in deciding asset prices. Similarly, when applied to the study of sports economics, the EMH tries to understand the rationality of decision makers in processing all available information across a variety of metrics, not limited to selecting players. Therein this theory would suggest that no team should be able to gain a consistent advantage, given the restraints imposed upon the clubs through the existing competitive balance policies. When applied to the context of this thesis, we could evaluate if the draft is used in conjunction with rational expectations and if there are any systemic errors in its current utilisation.

2.4.1 Rational Expectations

In general, we assume sporting clubs, like any other economic entity aims to maximise their profits (Leach & Szymanski, 2015).[5] In doing so, it is reasonable to assume this is achieved by winning games and leagues or at least try to win. However, irrationality is commonly observed when we believe that different agents (leagues, teams, players, managers, coaches etc.) have conflicting agendas which aren't in line with the presumed assumption (Bursik, 2012). This could be explained by the following.

[5] On the contrary, previous works have also suggested teams could be utility maximisers as well (Sloane, 1971).

2.4.1.1 Agency Problems

As touched upon earlier, it is important to consider the competing interest different agents have in the decision-making process. One of which is the objective of an individual to preserve their job within a club and inherently project their fear on to the decision-making process (Massey & Thaler, 2013). For example, coaches with continuous losing streaks may wish to trade up and select the best available players or conversely liquidate their picks to compensate veteran players. This would allow them to have the best possible roster to at least mitigate their immediate concern.

Second could be the objective of clubs overall to gain the best economic outcome. Commonly compensation for draftees is mandated by the collective bargaining agreement (CBA; (AFL, 2017; NFL, 2020)), where recruits are paid based on the round of the draft they were selected into the teams. Due to this clubs have been known to misconstrue their position in the draft to avoid having to pay higher wages to early draftees by trading to go down in the draft order (Mason, 1997). Though this cannot be considered a decisional irrationality, it creates the potential for conflict of interest between clubs and the league.

Thirdly, team decisions in terms of game day player selections can somewhat by influenced by fan perceptions (Hyatt et al., 2013). The authors in the preceding study, acknowledging the decline in NFL viewership, suggested teams involve fans in on-field and off-field selections. This could lead to situations where fans could insist on selecting famous players, who might not necessarily be the best in the list or suit the coach's game day strategy. Though this might not always be rational, sometimes, it could run contrary to the win maximising objective of the club.

2.4.1.2 Overconfidence

The seminal work by Massey and Thaler (2013) on the NFL draft suggested that teams tend to overvalue early picks in the draft compared to the latter. With much academic work reaffirming this by comparing expected performance to market value, teams have still continued to hedge early picks with a premium. The authors coined this as the 'overvaluing of the right to choose'. Retrospectively one could extend this to the decision maker's own self confidence in assessing talent in line with the expectation of the pick used to select them.

The problem lies when this behaviour is codified as a norm and expected henceforth. A common denominator in human decision making is that we tend to notice things that confirm our preconceived notions whilst ignoring anything that is contrary to our beliefs (Cohen, 1993). Once this process is repeated multiple times and coincidentally confirmed to be true by different agents, such biases could become stronger. Finally, this leads to familiarity, where people become unable to deviate from their own beliefs, even when they might not be true. For example, habitual investors tend to rely on a firm portfolio strategy once proved profitable and would decline diversifying even when it could potentially yield higher returns (Klayman & Ha, 1987). For example, Dufur and Feinberg (2009) explored the effect of race in draft decisions within the NFL. Their conclusions highlighted the overly cautious nature of decision makers, when contemplating drafting a player from a minority background, as they tend to have overtly rebellious traits, even if they were the next best available player.

2.4.1.3 Statistical Discrimination

Statistical discrimination is a situation where decision-makers resort to real average group behaviour in the absences of reliable personal or private information. In the labour market, such situations can be observed when an employee's personal group identifiers are valued over their independent marginal productivity (Arrow, 1971).

In the sporting arena, such prejudices can become evident in a variety of situations. For example, teams in the NFL have been known to draft players from esteemed college football programs, even though amateurs from low-profile schemes have been known to exceed expectations (Hendricks et al., 2003). On the adverse end, the Wonderlic scores (a cognitive ability test) correlated to the draft picks of players recruited through the NFL draft, signifying a form of race based discrimination as players from minority groups usually did not fare well in those situations (Gill & Brajer, 2012). Players from minority backgrounds could not fare well in the test as they might not have had access to the educational facilities as their counterparts. Similarly in the AFL, indigenous players were drafted at points inconsistent with their eventual performance (Mitchell et al., 2011). In both situations, players from minority backgrounds were disadvantaged as they were chosen later on in the draft, which did not correlate to their actual productivity.

In relation to game performance, there are different perspectives which influence the decision-making process. Some have argued that a player's size (Gabbett, 2014), position played (James et al., 2005; Vescovi et al., 2006) and experience (Motomura et al., 2016) could affect their on-field performance. For example, when evaluating on field stats in the AFL, ruckman would have many hitouts, which is in line with their positional purview, whilst midfielders will have more marks and kicks. Though the contribution these stats have on a team's ability to win a game might differ significantly, they ought to be evaluated in line with the position played by the player. Similarly, players selected and playing for teams in their home area had a higher chance of success as they were not deprived of their emotional structure (Jackson, 2016). Surprisingly, race has also been known to work in favour sometimes, as evidence from the AFL showed increased Brownlow medal votes[6] awarded to persons of indigenous descent (Lenten, 2017). Hence, irrespective of the performance measure used to evaluate a player, it is important to make necessary corrections for such group identities.

In summary, the common theme is that the behaviour of decision makers when selecting or utilising players is not always necessarily in the best interest of the team. Team managers and coaches could be heavily influenced by fan perceptions, club monetary situations and even their own personal interests of self-preservation. Furthermore, group identities such as socio-economic characteristics and physical metrics could also be a determinant of on-field outcomes. Hence any understanding of pick and player value based on on-field performance ought to be controlled and qualified for such factors.

[6] Brownlow medal votes are awarded in each game of the AFL regular season to the three best players as adjudged by the on-field umpires.

2.4.2 Other Aspects of the EMH

Whilst the EMH provides the basis to understand the behaviour of multiple agents, this section will explore the various scenarios within the context of the draft mechanism with the potential to observe such conduct.

2.4.2.1 Coase Theorem

The manner in which teams ought to select players has been subject to much debate and review. Brams and Straffin (1979) initially examined this and suggested that in a scenario where two or more teams chose players in a revolving order, the sincere outcome (or the best player that a team can pick at a given selection) is always Pareto optimal with respect to pairwise comparison. Assuming Richmond has the next pick in the draft, the person they select using the same pick should be the next best player in the amateur talent pool in consideration. However, if the next best player does not suit the needs of Richmond, the team would be better off trading the pick to go down the draft. Preferably the new draft position would help Richmond both select a player it needs and is essentially the next best player available at that point in the draft. However, Coase (1960) suggested that in the presence of an externality the market will achieve the efficient allocation of resources as long as transaction costs remain small and property rights are well defined (this is an extension of Rottenberg (1956) 'Invariance Principle'). This means if two teams trade their picks in the draft and chose their prospects, the yield of these players over time should be the same as if the trade never happened.

Hersch and Pelkowski (2016) explored the NFL draft pick trade market and concluded that the expected efficiency in a Coasian world was not achieved. The authors attributed this to a lower number of trades, high transaction costs, inability to find trading partners in a dynamic environment and increased scrutiny from external stakeholders (including the media and spectators). This also violated Massey and Thaler's (2013) advice of trading down, as teams trading up actually recouped higher returns. Yet, if a team is able to secure an arbitrage opportunity by trading both up and down, the optimal selection algorithm prescribed earlier is infringed as well.

In an ideal environment, however, players selected through the draft should have a monotonically declining outcome based on the pick that was used to recruit them. This assumption should hold even if the player is selected through a traded selection. Hence this creates an ideal opportunity for this hypothesis to be retested within the AFL draft and verify if there are no performance gains from players recruited through the picks that were traded. Therefore, if no such gains are visible should trading up illicit such a higher price? This loops back to the original question of value. If an accurate understanding of pick value is ascertained, such imperfections in market pricing would not occur.

2.4.2.2 Prospect Theory & Endowment Effect

Prospect theory is commonly used to conceptualise the decision-making process with uncertain payoffs. As per the expected utility theory, any rational agent would choose the best option upon assessing the marginal utility of each combination (von Neumann & Morgenstern, 1944). However, in defining prospect theory Kahneman and Tversky (1979) suggested that agents are generally loss averse and asymmetrically feel losses greater than an equivalent gain. These gains or losses are compared to a reference point which is subjective to each individual and situation (which is also a major critique of the theory as many externalities could affect the reference point (Koszegi & Rabin, 2007)), causing decisions to be made in relativity and not in absolutes.

Due to this gain-loss asymmetry, agents tend to hold on to the ownership of an object that they inherit, which they would not otherwise own, known as the endowment effect. The reason behind such behaviour being under weighing the opportunity cost of possessing an object (Thaler, 1980) caused by the psychological inertia governing the initial purchase decision (Gal, 2006).

Similarly, in the sporting world, the object referred to in the earlier discussion are the players. Assuming teams follow the win-maximising principle, they would only retain players who would effectively contribute to this goal. However, Staw and Hoang (1995) contradicted this assumption as teams in the National Basketball Association (NBA) gave more playing time and retained players selected early on in the draft, irrespective of their marginal productivity. Similar to the escalation of commitment (Staw, 1976) and disposition effect (Weber & Camerer, 1998) observed in the behavioural finance literature, the authors coined this as ‘sunk investment play’, as decision-makers threw good money after bad to justify the initial investment of drafting the player. This has been reaffirmed in the NBA (Coates & Oguntimein, 2010), NFL (Hendricks et al., 2003; Keefer, 2017) and NHL (Farah & Baker, 2021), whilst Borland et al. (2011) suggested minimal effects in the AFL. It is important to note, however, this behaviour is cultivated by the initial misconception of pick value and overconfidence. Once an accurate pick value index based on performance is created, it would be ideal to re-evaluate the presence of this effect in the AFL, if any.

Furthermore, an area that remains in its relative infancy is the manifestation of the endowment effect. As mentioned earlier, teams are not only allowed to select players using the draft picks allocated to them, but they are also permitted to trade them. Whilst the previous sections have aimed to provide an understanding of what value ought to be inferred on draft picks based on market value, compensation and expected performance, the endowment effect itself imputes an additional value on them. The price at which an owner of an object endowed upon them is willing to sell is usually higher than the price prospective buyers are willing to offer (Kahneman et al., 1990). Hobbs and Singh (2022) proved this effect in major American sporting competitions and even showed the likelihood of teams trying to recoup the picks they had once sold due to their irrational attachment pushing the reference point to the existing point and status quo (Bleichrodt, 2007; Schmidt, 2003).

Due to this, we can expect the effect to not only inflate value, but also compound across every subsequent trade (Morrison, 2000). For example, if team B purchases a pick from team A (the original team allocated the pick), and uses the pick to select a player, team B will more frequently hold the player longer than team A irrespective of their marginal productivity. If team C had obtained the same pick from team B, they will more frequently hold the player longer than team B. This happens because the reference point for each team shifts (or increases) with each exchange as the price at which they previous owner exchanges the pick includes an inflationary base. Hence it would be ideal to both evaluate the presence of the escalation effect in the draftee market within the AFL and also the potential for compounding the same effect in the effect of chain trades.

2.4.2.3 Perverse Incentives

With its genesis in insurance literature, the term "moral hazard" has entered the vernacular of many public domains today (Rowell & Connelly, 2012). However, its application to the study of economics primarily revolves around the incentives created to trigger a deliberate (compared to increased risk taking in a moral hazard situation) risky ex ante behaviour by an agent holding private knowledge. Within sports, this could be attested to the perverse incentives propagated by certain measures taken by the administrator of a contest to equalise the competition.

"Tanking" is one such situation proven by Taylor and Trogdon (2002) in the NBA by attributing such behaviour to the nature of the player draft. Though the NBA utilized the draft as a competitive balance policy, the order of selection dictated that the team that finished last in the previous season chose first, followed by the team finishing second last, which created an unintended ripple effect whereby clubs intentionally lost games to misconstrue their pecking order. The same was reaffirmed by Walters and Williams (2012) in the NBA, while others have reiterated it within the NHL as well (Fornwagner, 2018; Gold, 2011). In response, many authors have suggested alternative measures of pick allocation to discourage this behaviour (Gold, 2010; Lenten, 2016).

This also questions the policies in the AFL which may have unintentionally created an incentive to tank. Previously, Borland et al. (2009) studied the possibility of the AFL player draft causing similar behaviour as those observed in the NBA, and concluded on the contrary citing the homogeneity of players in the sport unlike in the NBA where a key player could be the difference between winning and losing. Yet, there has been a widely held belief that certain policies built into the draft do create similar incentives for teams to intentionally lose games (Denham, 2011). These include the PAS rules and the priority pick system within the AFL.

The bidding system for the PAS has a few loopholes that could be exploited. As the notion behind PAS bidding is to ensure having sufficient points in case of matching, teams could intentionally throw games and ensure a collection of early picks. Teams could also end up trading players for picks as well. Furthermore, there was potential for false bidding (whilst not applicable now as picks are exercised during the draft). Though never proven, teams could collude and nominate players that are eligible as PAS for rival teams. In doing so, they could deplete the points balance of PAS teams early on, pushing them out of competing against them in enticing other players.

Other rules that could potentially propagate incentives for tanking within the AFL could be priority picks. Introduced in 1993, they were awarded to teams which suffered prolonged periods of poor performance. The league essentially compensated these teams with draft picks in addition to their assigned selections, usually at the beginning of the draft, giving them ample opportunity to strengthen their lists with the best amateur talent. Initially, the Commission awarded these picks to any team that has five or less wins per season. However, with increased speculation that teams were intentionally losing games to make the cut (Paton, 2012), these rules were revised in 2006 and 2012, with the current regime giving the Commission discretionary power to award them. The only teams to receive these picks since the latest changes were Brisbane (Ryan, 2016), Gold Coast (Waterworth & Olle, 2019) and North Melbourne (Twomey, 2023).

2.5 Summary

The player draft is a key competitive balance measure used in closed sports codes around the world. The intricacies surrounding the local AFL version of this labour market intervention technique requires the mechanisms tied to it to operate effectively in order to reap the highest utility. First this chapter introduced the draft and the pick trading market emphasising the need for accurate pick valuation systems as the current alternatives are either based on salary metrics or restricted to current year pick only trades. Possible avenues for extending this work could be to form a pick value system based on match-to-match performance, which would evaluate both picks in the current year and the future whilst also providing a common denominator for picks and active players. Furthermore, the need for controlling any such pick value system for other factors such as race, physical metrics, decisional biases such as agency problems and overconfidence were explored as these could be determinants of match-to-match performance.

Whilst pick value and post draft performance play a critical part in achieving an efficient draft outcome, the initial contract lengths of draftees and the restriction on their free movement focus on the operational aspect of the draft. Though through decisional biases such as overconfidence and agency problems players could be laden with unrealistic expectations, it was understood that the initial investment made by teams on these drafted players usually do not lead to fruition within the restrictive initial contract period. This creates the need to ensure initial contracts remain fair to the drafting team whilst also not inhibiting an amateur player's ability to make economic gains.

On the other hand, a lack of understanding behind the drivers of pick and player value could lead to both an inefficient labour market leading the draft to be used in contraire to the intended outcomes of the league. These include tanking to get better draft picks and retaining recruited players beyond their marginal utility. Whilst these could be avoided through proper pick valuation methodologies proposed to be carried out through this thesis, it also provides ample opportunity to verify if such behaviours were prevalent in the AFL draft market to signify the adverse impacts of the current system.

Chapter 3: Equating Draft Picks and Active Players

This chapter is presented in the accepted format of the publication cited below.

Chandrakumaran, J. (2022). An Experimental Method in Juxtaposing Draft Picks and Active Players. *Economic Papers*, 41(1), 68-77.
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An Experimental Method in Juxtaposing Draft Picks and Active Players

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VICTORIA UNIVERSITY

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DECLARATION OF CO-AUTHORSHIP AND CO-CONTRIBUTION: PAPERS INCORPORATED IN THESIS

This declaration is to be completed for each conjointly authored publication and placed at the beginning of the thesis chapter in which the publication appears.

1. PUBLICATION DETAILS (to be completed by the candidate)

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2. CANDIDATE DECLARATION

I declare that the publication above meets the requirements to be included in the thesis as outlined in the HDR Policy and related Procedures – policy.vu.edu.au.

Signature	Date
[redacted]	3/08/2024

3. CO-AUTHOR(S) DECLARATION

In the case of the above publication, the following authors contributed to the work as follows:

The undersigned certify that:

1. They meet criteria for authorship in that they have participated in the conception, execution or interpretation of at least that part of the publication in their field of expertise;
2. They take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication;

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3. There are no other authors of the publication according to these criteria;

4. Potential conflicts of interest have been disclosed to a) granting bodies, b) the editor or publisher of journals or other publications, and c) the head of the responsible academic unit; and

5. The original data will be held for at least five years from the date indicated below and is stored at the following **location(s)**:

All electronic data will be stored on the Victoria University R drive. This is a secure central storage space maintained by Victoria University.

Name(s) of Co-Author(s)	Contribution (%)	Nature of Contribution	Signature	Date

Updated: September 2019

Abstract

Trading picks is a common transaction that is observed in sporting leagues that conduct player drafts. However, with its evolution, current iterations allow for the trading of picks and players, which in turn raises questions about valuing such trades. This study proposes a pick valuation system using survival analysis techniques, which was further extended to value players who were already enlisted in the league, creating a common denominator. The model proved to be viable, allowing to evaluate trades involving both picks and players.

Keywords

survival analysis; monotonic; pick value; hazard rate; Cox regression.

3.1 Introduction

In an effort to curtail the exhaustive bidding wars for amateur talent, the National Football League (NFL) created the first player draft in 1936. The order of selection followed a reverse order league standing system, whereby the team finishing last in the season prior to the draft chose first and the first last. Owing to its success, many leagues around the world have incorporated their own iterations of the draft including the Australian Football League (AFL) in 1986, which is the subject of this study. However, with the evolution of the drafting system itself, the league allowed the trading of picks for players, picks in the current year (from 2006) and selections in the future between clubs (from 2015), so that teams can make the decisions that would suit them both on field in winning games and off field financially.[7]

Yet as draft picks themselves are indivisible assets, a suitable currency for trading is called for. Much literature has been developed into alternative valuation methods of picks

[7] Career compensation of early draft picks are generally high. If a team is intending to choose a player that they know would not be selected prematurely and they have an early pick, it would be in their best interest to relieve the pick in lieu of selections later on, to avoid hefty salary negotiations.

both in the current[8] and future,[9] with the league using a common value function called the Draft Value Index (DVI). However, as these methods could not be reciprocated to value active players, their use in evaluating trades including picks and players proved to be limited. This study thereby aims to introduce a common denomination, whereby the value of a player who is actively listed in a team could be reciprocated to that of a pick.

Much debate has prevailed in the sporting world on the valuation of active players. The prevailing alternatives suggest games played, career length and even player ratings. However, a rational argument could be made that the most suitable indicator of value is the interaction between career length and games played, as it represents both a player's ability to continue and a team's interest to employ the same. For example, a player who has played 50 games over 10 years is worth less when compared to another with 50 under his belt in 3 seasons. In the medical profession, survival analysis is used to evaluate similar binary outcomes over time, such as in clinical trials of new pharmaceuticals. The outcome there would be dead or alive, while a cohort of predictors dictate the time to this event. Glasson and Bedford (2009), utilised the same technique within the AFL, to evaluate the probability of a draftee surviving in the league after playing a number of games. Following the same conjecture, one could suggest that the ability of a rookie selected in the draft to survive[10] in the league could be compared to that of someone who is already listed to play and hence we propose a model inspired by survival analysis techniques.

3.2 Draft Value Index

Before moving onto the alternative method proposed within this study, it is important to understand the prevailing pick value system in the AFL. In an effort to foster familial and regional ties, the league introduced two priority access selections (PAS), known as the father-son (F/S) and club-academy (C/A) rules. F/S has prevailed before the draft itself

[8] Current studies have suggested pick values by regressing games played (Conlin & Emerson, 2005; Hurley et al., 2012; Schuckers, 2011a), time on field (Schuckers, 2011b) and player ratings (Mitchell et al., 2011; Stewart et al., 2016) to name a few.
[9] Taylor et al. (2018) proposed a model by which picks in the current year could be traded against those in the future within the NFL.
[10] Please note that the term 'survive' is used loosely throughout this paper to explain a player's ability to last in the league and not be dropped from the squad.

and allows a team to recruit a rookie who is the son of a former player given that the latter has played a set number of games for the club, while C/A permitted the enlistment of amateurs who were trained by the teams' own junior academies. However, both PAS only provided teams with priority access (not exclusive access) and required the clubs which enforced this rule to forgo draft picks in return for picking early on. Prior to 2007, a team that used the F/S rule had to nominate the player who they wished to draft prior to the draft itself and surrendered their third-round pick in return. This provided teams using PAS an unfair advantage, as the third round pick did not accurately represent the calibre of the players they drafted (Stewart et al., 2016). Hence this rule was revised in 2012 so that teams had to renounce picks in the same round as a valid bid made for the player by a rival bid, before the DVI was introduced.

In 2015, the league promoted the DVI which was created by fitting the career compensation of draftees selected over 15 years (AFL, 2015a). The index thereby created a benchmark for teams which utilised the PAS rules to surrender picks which represented the competing bid by a rival club and for those who simply exchanged selections between each other. Even though this system did show traits of overvaluing early selections (Chandrakumaran, 2021), like those observed in the NFL's pick value chart (Massey & Thaler, 2013), it did not address the comparison of draft picks and active players similar to its academic counterparts discussed in footnotes 8 and 9, further validating the need for this study.

3.3 Pick Value

In order to validate to validate this technique, career data on all 1,123 draftees from the AFL selected between 2003 and 2016, with their respective performance from 2004 to 2017 was obtained from Sorenson Technologies. As the AFL allows the drafting of experienced players unlike its North American counterparts, players who have played before together with rookie elevations[11] were removed from the sample leaving 908

[11] If a team has a player in their rookie list, and they wish to use him as a senior in the next season, clubs are forced to use a draft pick to do so. However, as the players in concern are already in the team list, clubs generally use later selections to exercise this rule. As these rookies are experienced themselves, the picks used to promote them usually did not represent their abilities and hence were needed to be omitted in order to remove any inherent biases.

actual amateurs. The summary statistics of the integer variables are given in Table 3.1. Of this, 48% are still actively playing in the league as of 2017, and hence did not achieve the hazard event of being dropped, while 86% have played at least one game.

Table 3.1: Descriptive Statistics

Variable	All	Indigenous	Father-Son	Club-Academy
Record Count				
Player Careers	908	50	35	21
Player Seasons	4781	343	192	41
Average Career Aggregates				
Games Played	54.45	80.96	62.37	16.95
Time on Field (in minutes)	3434.72	5214.51	4042.99	1085.56
Brownlow Votes	6.72	9.54	11.26	0.76
Average Season Aggregates				
Games Played	10.15	11.8	11.37	8.68
Time on Field (in minutes)	652.32	760.13	737	556.02
Brownlow Votes	1.28	1.39	2.05	0.39
Average Age				
When Drafted	18.18	17.98	18.03	18.24
Season	22.24	22.65	22.2	19.95
Average Pick Number	33.78	32.08	39.65	31.43
% of Seasons Played for Drafting Team	86%	85%	85%	97%
Position Played				
Defender	33%	26%	28%	24%
Forward	29%	50%	26%	28%
Midfielder	32%	22%	43%	48%
Ruckman	6%	2%	3%	0%
Amateur League				
TAC Cup[12]	53%	12%	74%	14%
WAFL	17%	44%	17%	0%
SANFL	16%	20%	3%	0%
Others	14%	24%	6%	86%

For the purposes of this experiment, the survival estimate ($S(t)$) of a draftee being active in the league upon playing t games is given in Equation 3.1.

[12] Currently this is referred to as the NAB League.

$$S(t) = P(T > t) = \int_{t}^{\infty} f(u)du = 1 - F(t) \quad (3.1)$$

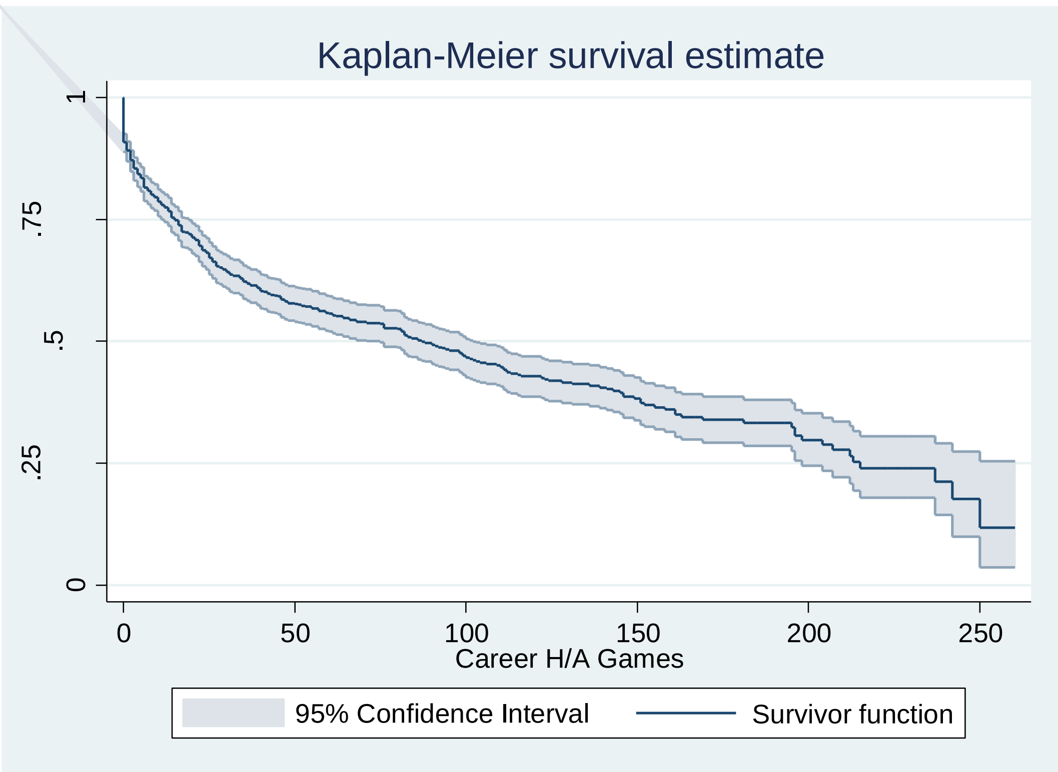
After the survival function of a draftee's career was modelled using regular season home and away games, the Kaplan-Meier survival estimate of all draftees in the sample was plotted in Figure 3.1. The curve shows the probability of a draftee surviving in the league, should he play *t* games. Based on the graph we could deduce that a draftee would play a median of 86 games in his career.[13] For ease of reference, a table with the individual survival rates at major milestones is given in Table 3.2. Here we can see that rookie with 25 games has a 67% chance of surviving in the league, while a player with 250 has only 12%. It is worth noting that the possibility of being dropped with zero games under the belt is the highest risk at any point in a draftee's career with 9%,[14] and the next highest decrease in survival is observed between games 248 and 250 at 6%.

Table 3.2: Survival estimates at key milestones

Games Played (t)	Survival Estimate (S(t))
1	0.89
25	0.67
50	0.57
100	0.46
150	0.37
200	0.30
250	0.12

[13] At y=0.5, cross reference the value of x.
[14] The body of this paper always follows survival estimates. The inverse of this is the hazard. The chance of survival at 0 games is 91% and hence the hazard is 1-0.91, which is 9%.

Figure 3.1: Survival estimates of draftees selected between 2003 and 2016



While the above method allows the prediction of draftee's career length, to value each individual selection in the draft, a Cox proportional hazards model was used. A classical model with a vector of *x* predictors to achieve a hazard of the *i*th pick is given in Equation 3.2.

$$h_i(t) = h(0) * \exp\left(\sum_{i=1}^{\infty}(\beta_i x_i)\right) \tag{3.2}$$

The term *h(0)* refers to the baseline hazard rate which is further shifted based on the predictors. For the purposes of this study, the selection number is used as the sole predictor variable[15] with one minus the survival estimate for any draftee at games=0 set

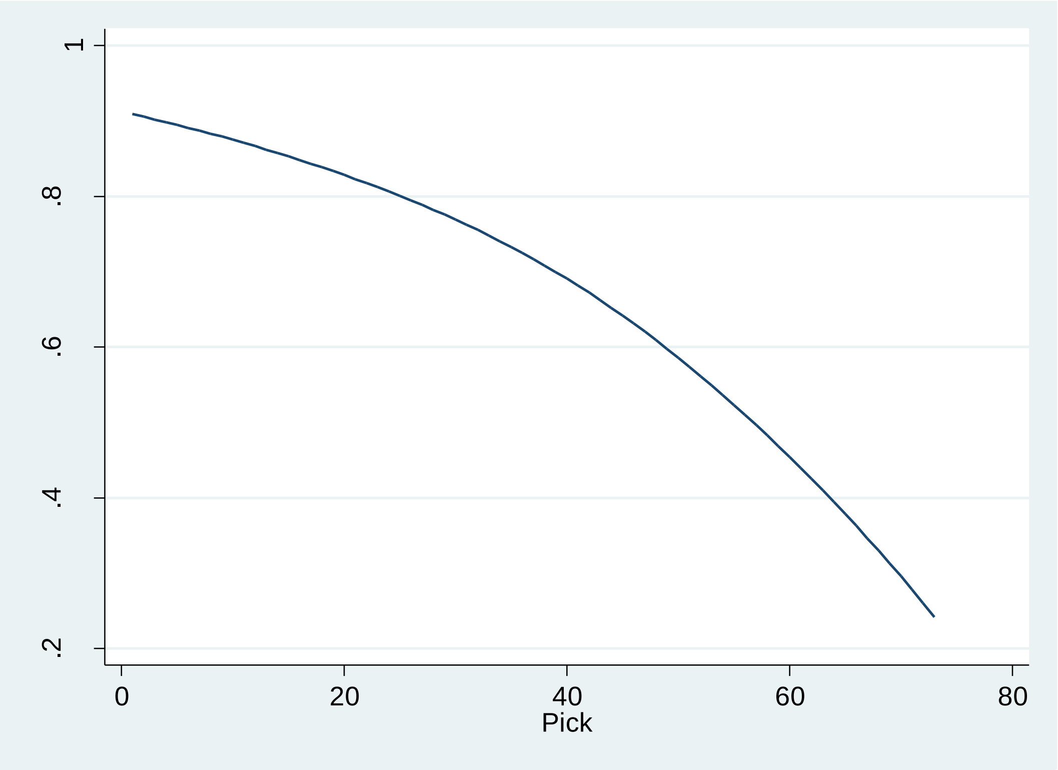
[15] The vector of variables also included other social and performance predictors, like player position, team played, amateur league and age similar to those used by Stewart et al. (2016) and Chandrakumaran (2021), but yielded insignificant values (refer to Table S3.1) and hence were dropped in the final model. As these variables are a determinant of performance and not survival, the insignificance was accepted. Moreover, personal injury is quite a common determinant of career length. However, the data on such items is scare in the AFL and has only been recently included.

as *h(0)*. Also, as the survival estimate is used as the common denomination across all aspects of the final trade evaluation model, Equation 3.2 is retrospectively augmented from estimating the proportional hazard to survival in Equation 3.3 as shown below.

$$S_i(0) = 1 - \left(\left(1 - S(0)\right) * \exp(\beta_1 Pick_i)\right) \tag{3.3}$$

After setting the cross-sectional data as a survival data panel, *S(0)* was estimated as 0.9086 with β_1 having a coefficient of 0.0292716 significant at 0.01. The predicted survival estimates of each selection in the draft is graphically represented in Figure 3.2.

Figure 3.2: Survival estimates per draft selection at t=0



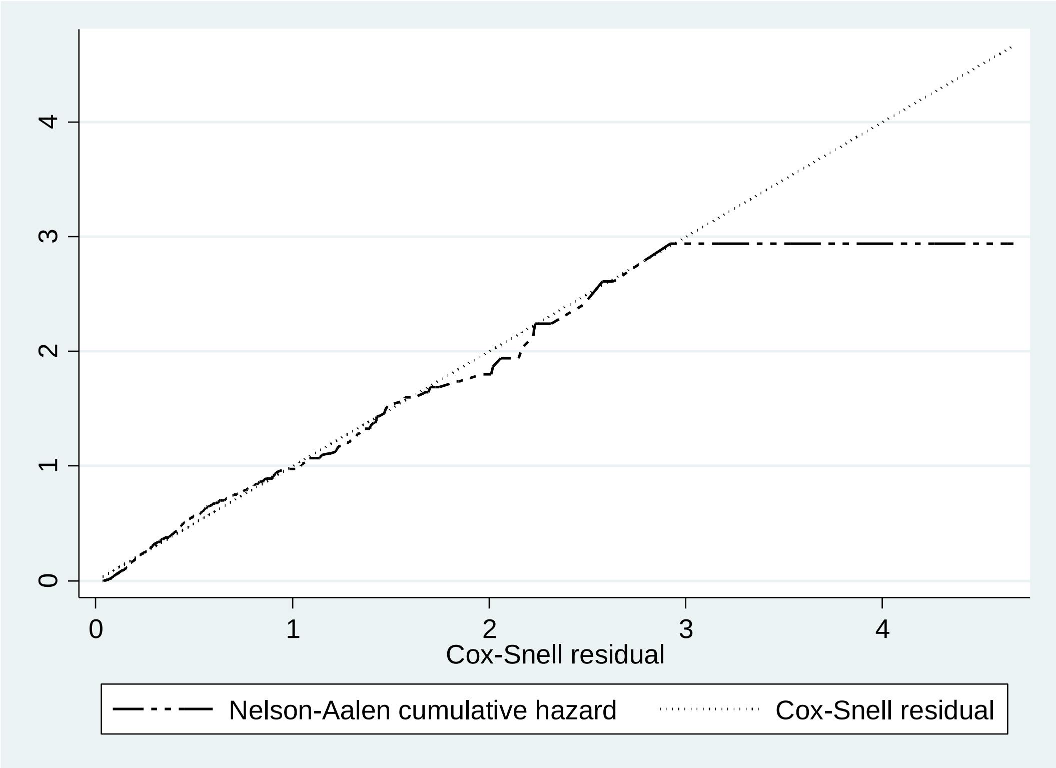
Unlike the conventional valuation systems, the survival estimates, still keeping to a monotonic decrease, followed a concave function through the draft with pick 1 coming in at 0.90 and pick 16 at 0.85. In the meantime, almost all prevailing alternatives that use performance as the determinant of pick value, follow an exponential convex decline.

However, as performance itself is determined not only through the calibre of the player but also incorporates sunk investment plays (Staw & Hoang, 1995) of decision makers justifying their speculation, one could argue that the exponential decline that is commonly observed itself is questionable (Massey & Thaler, 2013). Sunk investment plays or escalation of commitment is commonly referred to the manner in which decision makers throw good money after bad. For example, if a coach recruits a player at pick 1, and the draftee turns out to be a bust, the decision maker would tend to still play this player to justify his initial investment. This in turn skews the performance metrics of draftees as their actual output is not always a true representation of skill. Chandrakumaran (2021) proved this within the context of the AFL, by showing that the selections later on in the draft provide a much higher surplus of output, when compared to their expectations. Moreover, the difference in value between picks 1 and 16 in the AFL DVI is 64%, whereas the survival estimates suggest 6%. Even though there are 14 players between the two selections, the greater mismatch in value in the AFL DVI is not justifiable, given that both picks occur in the first round of the draft[16] and that there is much homogeneity in the sample. This homogeneity is described by Borland et al. (2009) and Chandrakumaran (2020) as the main reason for the absence of perverse incentives in the AFL, as the marginal contributions between amateurs in the AFL is comparatively low (being an 18 man per side game and players switching positions continuously to suit the flow of the contest), unlike the National Basketball Association (NBA), where a key player can be the difference between winning and losing. The concave decline on the contrary, observed here, speaks to the ability of the rookie to last in the league as an active player, which is usually determined through continuous effort. Though it may not be completely immune to decisional biases, the effects of such are comparatively low, as per the comments of the previous authors in utilising performance instead.

Finally, as a robustness check, the Cox-Snell residuals were mapped in Figure 3.3 which shows the Nelson-Aalen cumulative hazard following the prior closely at a 45-degree angle except for very large values. As the median in the sample is 86, and the data spans across till 260 career games, this variation in the larger values is deemed acceptable.

[16] Each round consists of 18 selections representing the 18 teams in the current AFL list.

Figure 3.3: Fitted residuals of the final estimation



3.4 Active Player Value

In order to achieve a coherent valuation system across these two categories, Equation 3.1 was substituted to obtain the survival estimates of all players who have been recruited between 1995 and 2016 with their respective performance till 2017. However, in order to incorporate the issue of time in terms of games and seasons, the survival functions were estimated by identifying the status of the hazard per season. For example, if player *X* played 10 games in season 1 and is listed to play in the league thereafter, a value of 10 would be recorded against time *t* and the hazard noted as non-achieved. On the other hand, if the same player plays 15 games in season 2 and dropped in the same, his cross section will record a value of 25 for *t* and put down an attainment of the hazard from that season onwards. The Kaplan-Meier survival functions of lasting in the league upon playing *t* games per season is given below in Figure 3.4 with reference to key games in Table 3.3.

Figure 3.4: Survival estimates of all players per season

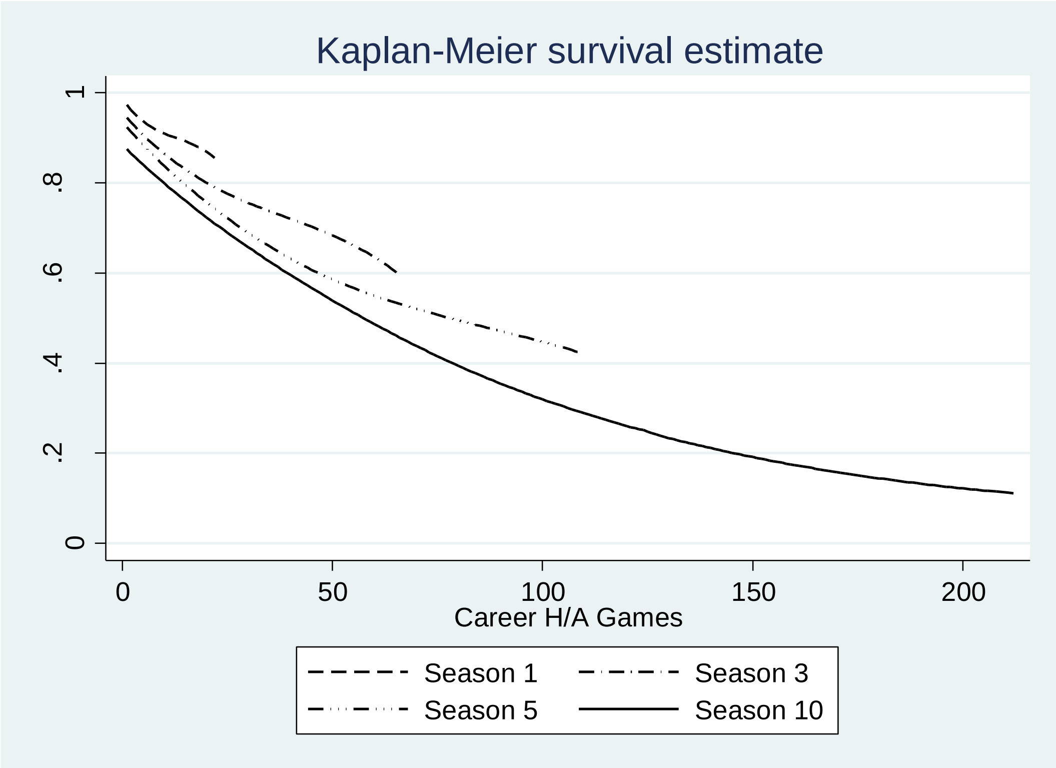


Table 3.3: Survival estimates of all players at game *t* per season

Survival at Game	Season 1	Season 3	Season 5	Season 10
10	0.91	0.85	0.83	0.80
22	0.84	0.78	0.73	0.69
35	-	0.74	0.64	0.59
50	-	0.69	0.58	0.51
100	-	-	0.46	0.31

The values presented in Table 3.3, clearly represent the concern raised in the introduction of games and season played. For example, a player who played 50 games in his third season has a 69% chance of surviving, while a player with the same number of games in his tenth season only had a 51% chance. Together this index allowed the valuation of players who are actively playing in the league.

3.5 Practical Application

In order to evaluate the effectiveness of the predicted models, we look into three previous trades in the AFL and estimate the value traded between the two parties.

In 2004, Geelong obtained the 12th overall pick by trading Brent Moloney to Melbourne. At the time of the trade, Moloney had played two seasons in the AFL and had 20 regular season games under his belt which is attributed to have 0.85 chance of survival. Comparing that to the 0.87 credited to the 12th pick (calculated using Equation 3.3), one could argue that this trade was equitable for both teams even though Geelong has a 0.02 edge over Melbourne.

The 2013 Elliot Yeo (27 games in 2 seasons) trade from Brisbane to West Coast for the 28th selection overall resembled a similar outcome as observed before. With Yeo having a 0.83 survival rate and the 28th pick 0.79, West Coast scored a slight edge over Brisbane in this trade.

In order to obtain Tom Bell in 2015, Brisbane had to relieve picks 21 (0.83) and 60 (0.47). However, they were able to obtain the key player together with pick 41 (0.7) in return. Bell had played 49 regular season games over four seasons at the time of the trade, which gave him a 0.62 chance of surviving. Using the valuation techniques that were discussed earlier, Brisbane obtained a negligible 0.02 higher survival in their transfer, making the trade fairly equitable.

Though this is not a suitable representation of the total population of trades in the AFL, the three that have been evaluated above, clearly show that the value transferred between the two parties are approximately the same.

The common issue with the prevailing systems of pick valuation is that they all use a metric for the future such as expected games. This allows for the valuation of picks both in the present and the discounting of the same in the future. However, when one trades selections for players who are actively playing in the league, future performance alone cannot be utilised to equate each other. This required the comparison of both future games and career length, cementing the need for the survival model, which yielded a suitable valuation system.

3.6 Conclusion

Through the body of this paper, we have introduced a method that not only allows the valuation of picks, but also equivalently attributes the desirability of an active player. Whilst it is of no doubt that these models could be further expanded on to increase the accuracy of the findings, the two together have allowed for the evaluation of trades involving picks in the current year and listed players as set out in the introduction. Moreover, the decline in pick value observed under the survival estimate function in Figure 3.2 is much less than that proposed in the current AFL DVI (AFL, 2015a). This further validates the claims made by Chandrakumaran (2021) that the choice of career compensation to create the league's DVI does not properly describe pick value. On the other hand, similar to the previous author's model, the lower rate of decline further suggests that it is in the best interest of a team to trade down and select players using later picks, which is against conventional wisdom. However, the greatest addition to this is that the valuation system allows for the study of managerial decisions behind the trades themselves. For example, one could hypothesize that a new coach assigned to a team with a losing margin over a number of years would opt to get experienced players with lower survival ratings in lieu of picks to increase his chance of winning quickly rather than developing rookies over time. Hence it is of no doubt that both the models could be improved and also used to explore avenues in decision analysis.

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Appendix

Table S3.1: Cox Proportional Hazard Model

VARIABLES	Coefficient	Standard Error
Pick	0.03***	0.00
Drafting Age	-0.12	0.05
Special Category Picks [a]		
Club Academy prior to 2015	0.01	0.33
Club Academy after to 2015	-0.31	0.46
Father Son prior to 2007	-44.02	0.00
Father Son between 2007 and 2014	-0.16	0.75
Father Son after 2014	-44.78	0.00
Indigenous [a]	-0.01	0.20
Weight	-0.07	0.01
Height	0.07	0.02
Drafting Team [b]		
Brisbane Lions	0.11	0.33
Carlton	0.68*	0.32
Collingwood	0.23	0.34
Essendon	0.25	0.32
Fremantle	0.43	0.32
Geelong	0.15	0.35
Gold Coast	0.30	0.44
Greater Western Sydney	-0.49	0.64
Hawthorn	0.20	0.33
Melbourne	0.27	0.32
North Melbourne	0.18	0.34
Port Adelaide	0.07	0.33
Richmond	0.24	0.32
St. Kilda	0.01	0.38

Sydney	0.54	0.36
West Coast	0.11	0.35
Western Bulldogs	-0.05	0.35
Amateur League prior to being drafted [b]		
SANFL	0.02	0.21
TAC	-0.10	0.19
WAFL	0.15	0.20
Position Played [b]		
Forward	0.24*	0.14
Midfielder	-0.18	0.15
Ruckman	0.08	0.28
Observations	784	

*** p<0.01, ** p<0.05, * p<0.1; [a] Dummy variable; [b] Indicator variables with one reference group

Chapter 4: Discounting Future Picks

This chapter is presented in the accepted format of the publication cited below.

Chandrakumaran, J., Larkin, P., McIntosh, S. & Robertson, S. (2024). Deferring draft picks: Empirical analysis of the AFL draft. *PLoS ONE*, 19(9). DOI: 10.1371/journal.pone.0311240

PLOS ONE

RESEARCH ARTICLE

Deferring draft picks: Empirical analysis of the AFL draft

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DECLARATION OF CO-AUTHORSHIP AND CO-CONTRIBUTION: PAPERS INCORPORATED IN THESIS

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Name(s) of Co-Author(s)	Contribution (%)	Nature of Contribution	Signature	Date
Paul Larkin	15%	Assisted with conceiving the study, manuscript development and revision.	[redacted]	3/10/24
Sam McIntosh	15%	Assisted with conceiving the study, data analysis, validation and revision.		9/10/24
Sam Robertson	10%	Assisted with conceiving the study, feedback and revision.		8/10/24

Updated: September 2019

Abstract

Trading picks is a common transaction observed in sporting leagues that employ player drafts. However, many current and revised draft formats employed by professional leagues allow for the trading of picks in the current year for those in the future. This in turn raises a question of an appropriate rate of discount which can be used to account for the delay in relinquishing current picks for those in the future. This study proposes a discount rate function in the Australian Football League based on the difference between a player's contribution to his team in his first season to that of his career. The findings reveal a varying discount rate that decreases with the progression of the draft ranging between 42% and 51%, given the increasing deviation of post draft outcomes in the same range. Furthermore, after discounting said picks for four years, the variance in pick reduced considerably as poor performers are delisted after their initial contract period. Upon adopting the model to evaluate previous trades, it is evident that almost all parties infer a higher value on current year selections than future selections (discounting future picks by up to 120%), seeking instant returns over deferred options. Hence, a decision maker trying to capitalise on pick value only would be better off deferring the right to choose in the current year.

Keywords

Decision analysis; player draft; football; pick value; competitive balance

4.1 Introduction

Player drafts are commonly used in closed sports leagues as a way to disperse amateur talent in an equitable manner. Introduced first in the National Football League (NFL), the draft used a reverse order system based on each team's season standing (Maxcy, 2012). For example, the team finishing last immediately before the draft would have the first pick followed by the second last team and so on. Once a complete set of selections have been made, the process is repeated again (around seven times in the current NFL draft). Owing to its success, derivatives of the draft have been incorporated in various other leagues including the National Hockey League (NHL), National Basketball Association (NBA), and Major League Baseball (MLB). In order for teams to pursue their own interests in terms of recruitment, leagues have allowed for the trading of picks, essentially making the selections themselves financial assets owned by the benefitting clubs. When prompted, a team can either opt to exercise the pick and choose an amateur player to strengthen its list; or trade the pick for a player(s) and/or pick(s). As the assets in question are both indivisible and come from different classes, ample guidance has been given in the prevailing literature to facilitate the value-in-exchange similar to a barter system (Schuckers, 2011a, 2011b).

In addition to this, leagues have also allowed for the trading of current year picks for those in the future (Bowen, 2015). Whilst unlike the previous issue of comparing different asset classes, these exchanges will require the evaluation of picks across different time periods. Any set of intertemporal choices happening across different time periods, should be discounted whereby the utility of consumption should be perceived at the present time (Fisher, 1930). In a purely financial sense, investment decisions involving multi-year payoffs are discounted based on the cost of capital. For example, a mutual fund scheme returning $2 at the end of year with an initial investment of $1 today, cannot be automatically attributed a profit of $1 ($2-$1). As the profit is realised in a year's time, this should be discounted to today's terms by the cost of capital. Assuming this is 10%, the $2 is worth $1.82 today (2/1.1). Hence, the true profit of this scheme would be $0.82 instead. Yet, when such decisions involve a non-monetary return, an implied discount rate is used to assess the perceived difference between current and future payoffs. However, these implied rates generally include other psychological factors on top of the discounted utility aspect. The theory of intertemporal consumption suggests that an individual's preferences in terms of consumption or saving varies across their lifetime. Early attempts to refine this theory showed shifts in behaviour where individuals would prioritise saving over spending in their middle years in effort to secure their retirement (Harrod, 1948). Traditional models of economics assumes that any rational agent's preference would decrease monotonically with increased time delay (Green & Myerson, 2004). The basic idea here is that when all things remain equal, an agent would prefer to have something now as opposed to later (Kahneman et al., 1990).

Within the context of the draft, let's assume team A is eyeing a key amateur in the current year's drafting cohort and has only pick nine in the current year. This team would then have to agree with team B to exchange picks from their future years to obtain a current year pick, earlier than their spot at nine (let's say pick five). However, team B would not value picks in the future to be of equivalent standing to those in the current year as there is a delay in realising the benefit of those picks. Hence team B would evaluate any proposal from team A to relieve its fifth pick in the current year by discounting team A's picks from the future. Previously, Massey and Thaler (2013) estimated an implied discount rate of 136% for multi-year trades by managers in the NFL by equating each trade over two decades using a Weibull distribution. That is, if pick 5 is worth 100 today, the same pick from next year's draft has been estimated to be worth 64 by NFL decision makers (100*(100-36)). Taylor et al. (2018) found that this rate ranged between -172% and 626%, owing to the need of clubs favouring current year picks (and by extension, access to high-quality recruits early on) to advance their goal of building a winning roster. Needless to say, these competing interests create arbitrage opportunities for the parties involved in the trade to profit off the other, causing an inefficient trading market. These implied discount rates reflect market rates and include both the actual discount factor and any gain/loss asymmetry, such as a team's individual requirements to hold a list spot open or tackling the unknown of what the future draft pick position might be, which teams attribute on top. This still leaves the question, of the manner in which future picks should be discounted. Hence, through this paper we aim to a introduce discount function based on historic player performance data (unlike Massey and Thaler (2013), who looked at historical trade data) which can used to evaluate pick trades involving current and future year draft picks.

4.2 Empirical Analysis of the AFL Draft

In order to answer the question of an appropriate discount rate, we used the AFL national player draft due to its uniqueness and effectiveness in the trade market. Unlike most North American leagues, the AFL conducts a smaller draft and requires a team to maintain a smaller roster, indirectly promoting sequential selection parity, where the performance of players selected through the draft closely resembles the pick used to recruit them (Chandrakumaran, 2021). Furthermore, as each team has to have 18 players on field per game, the impact of a single player (and/or position) in a game is significantly less when compared to other sporting codes like the NBA or NHL, making the talent pool more homogenous. Incorporated in 1986, the AFL national player draft is a labour market intervention technique used to discourage expensive bidding wars and equitably distribute amateur talent (Booth, 2005). It uses a reverse order system, allowing the team that finished last in the season immediately prior to the draft to select first, and so on. After all teams complete a set (currently 18; referring to the number of teams in the AFL) of selections (known as a round), the process is repeated until each team has made enough selections to fit within the list size guidelines. This is typically around four-to-five rounds in the current format of the draft. Through this, the league hopes to cyclically alter the fortunes of all teams and deny the continued dominance of a select few (Booth, 2004), assuming teams choose the best (optimal choice (Brams & Straffin, 1979)) player with each pick. Similar to its North American counterparts the AFL draft allows teams to trade picks for active players, and other picks. The current body of knowledge facilitates the evaluation of such exchanges (Chandrakumaran, 2022; Chandrakumaran, Stewart, et al., 2023; O'Shaughnessy, 2010), except those involving picks from the future.

4.2.1 Data

In order to create the discount rate models, data on all draftees selected between 2003 and 2016 together with their performance from 2004 to 2017 was collected from Sorenson Technologies and supplemented using third-party websites (including footywire.com, afltables.com, and draftguru.com). This yielded a sample of 1,123 players. As the AFL allows teams to draft players who have played in the league before and elevate amateurs from their rookie list to the senior squad through the draft, such observations were removed from the sample to avoid any biases they might infer when compared to their amateur counterparts. Furthermore, to have a consistent endpoint, draftees selected after pick 73 (this is also the end point of the league-administered pick value function (AFL, 2015a) – though a future iteration of this in 2025 would stop at pick 53 (Twomey, 2024a)) were eliminated, which coincidentally included a majority of the observations filtered in the previous exception. This left 905 career cross-sections and 4,781 player seasons. Table 4.1 describes the primary variables used throughout this study.

Table 4.1: Description of the independent and dependent variables used in the models

Variable	Description
	Dependent Variables
Games Played	The number of regular season games played throughout a draftee’s career. Post-season matches are not included as it may create an inherent bias towards players from successful teams who get to play more games.
Brownlow Medal Votes (BMV)	BMV are awarded by umpires to determine the league’s best and fairest. The top three players for each game are awarded these votes, with the best player getting three votes, whilst the second and third get two and one respectively. This variable accounts for the total BMV accumulated throughout their career in the above games.
Contribution to Margin of Victory (CMV)	The CMV metric was obtained by regressing the difference of a set of on-field metrics such as kicks and marks, which translated to point differences in a regular season AFL game between 2003 and 2017 as shown in Table S4.1. After refining the predictors using a stepwise analysis accounting for Bayesian Information Criterion, the coefficients in model 4.9 of Table S4.1 were used to extrapolate the career and seasonal CMV per draftee used in this study. This variable has been used in similar studies (Chandrakumaran, 2021; Chandrakumaran et al., 2024a) and mimics the process followed in other similar works (Robertson, Back, et al., 2016; Stewart et al., 2007; Sullivan et al., 2014), including the proprietary Champion Data player ranking points that is widely used in the AFL.
	Independent Variables
Drafting Age	Age of the draftee in the year when he was drafted.
Indigenous	Indicator variable to identify if a draftee is Indigenous.
Father–son (F/S)	This is a special selection type whereby teams select the sons of former players who have played 100 games for the respective club. Within the sample time period, the rule was exercised under three different regimes. Given the nature of these changes, it was essential to capture these effects (if any) similar to previous works (Chandrakumaran, 2021; Stewart et al., 2016). ≤2006 = Team that chose F/S players in or prior to the 2006 draft were only meant to compensate the competing bid for the same pick with a third-round pick. Due to this, the expected performance of such players did not reconcile with the pick used to select them.

Variable	Description
	2007 ≤ 2014 = For F/S players chosen between 2007 and 2014 teams were meant to match a bid for the same player with a pick in the same round. While this is said to have reduced the mismatch, there was still a chance for a material difference in outcomes. ≥2015 = The DVI was introduced in 2015, whereby teams choosing F/S players had to compensate competing bids with equivalent draft points.
Club academy (C/A)	Similar to F/S players, this is also another special category whereby teams recruit players from their own junior academies to join their senior ranks. Teams from New South Wales and Queensland were given the opportunity to develop amateur Australian Football talent through these academies, in order to make them ready for potential careers in the AFL, as young athletes in these regions usually followed the premier rugby league competitions instead due to its overwhelming popularity. It also follows the same rules as F/S in terms of draft selection. Since it was introduced only in 2011, they only follow the last two iterations of the F/S rule. ≤ 2014 = For C/A players chosen up to 2014 teams were meant to match a bid for the same player with a pick in the same round. ≥2015 = The DVI was introduced in 2015, whereby teams choosing C/A
Height	Height in centimetres.
Weight	Weight in kilograms.
Position	The most common position played by the player in their career.
Drafting Team	Team that drafted the player.
Amateur League	The amateur league from which the draftee is recruited.

The descriptive statistics of all continuous variables used are presented in Table 4.2. On average, draftees play 54 games in their career, earning 7 Brownlow Medal Votes (BMV), and contributing 680 points to their team's victory margin (CMV, a weighted sum of in-game statistics with the weights derived by a linear regression in model 4.9 of Table S4.1). The distribution of these dependent performance variables (games played, BMV, and CMV) is shown in Figures S4.1, S4.2, and S4.3 together with their averages per draft pick in Figure 4.1. On the other hand, and consistent with previous findings, there was minimal deviation in terms of the personal metrics such as drafting age, height, and weight (Larkin et al., 2021). Yet, upon viewing the dispersion of draftees who have not played at least one game in the league, the density function in Figure 4.2 shows a growing trend with the progression of the draft that drops in the tail, mimicking the performance risk associated with such selections.

Table 4.2: Descriptive statistics of continuous variables used in the models

Variable	Mean	Median	Min	Max	Inter-Quartile Range	Standard Deviation
Games Played	53.56	28.00	0.00	260.00	81.00	60.75
BMV	6.73	0.00	0.00	181.00	3.00	19.49
CMV	680.24	264.57	0.00	5,011.71	957.36	933.55
Drafting Age	18.16	18.00	17.00	26.00	0.00	1.07
Weight	84.93	84.00	63.00	112.31	10.39	7.86
Height	188.14	187.65	167.81	208.88	10.00	6.84

Table 4.3: Career listing outcomes of draftees and their respective performance since being drafted

Years Since First Drafted	No. of Draftees Eligible to Play	No. of Draftees Listed in the year	No. of Draftees who Played in the year	Averages per year of listed draftees					Year-on-Year CMV increase
				Age	Pick	Games Played	BMV	CMV	
1	905	905	531	19.17	33.69	4.91	0.15	48.23	-
2	833	828	610	20.14	33.30	7.73	0.38	84.58	1.75
3	766	686	575	21.12	31.48	9.84	0.80	117.35	1.39
4	697	570	504	22.09	30.03	11.77	1.53	149.98	1.28
5	638	447	408	23.05	28.34	12.59	1.76	166.90	1.11
6	578	371	335	24.03	28.06	13.18	2.19	181.31	1.09
7	513	289	267	24.99	26.83	13.74	2.28	191.87	1.06
8	445	226	213	25.94	26.09	14.06	2.73	197.97	1.03
9	382	172	160	26.92	25.08	14.65	3.04	209.51	1.06
10	312	126	121	27.92	25.32	14.53	3.34	210.48	1.00
11	249	87	80	28.85	26.38	13.97	2.55	196.96	0.94
12	179	45	39	29.62	21.69	13.16	3.09	206.28	1.05
13	118	23	21	30.57	21.91	12.39	1.78	171.07	0.83
14	57	6	6	31.33	33.67	10.83	0.83	161.86	0.95

Figure 4.1: Dispersion of career performance metrics grouped based on draft picks

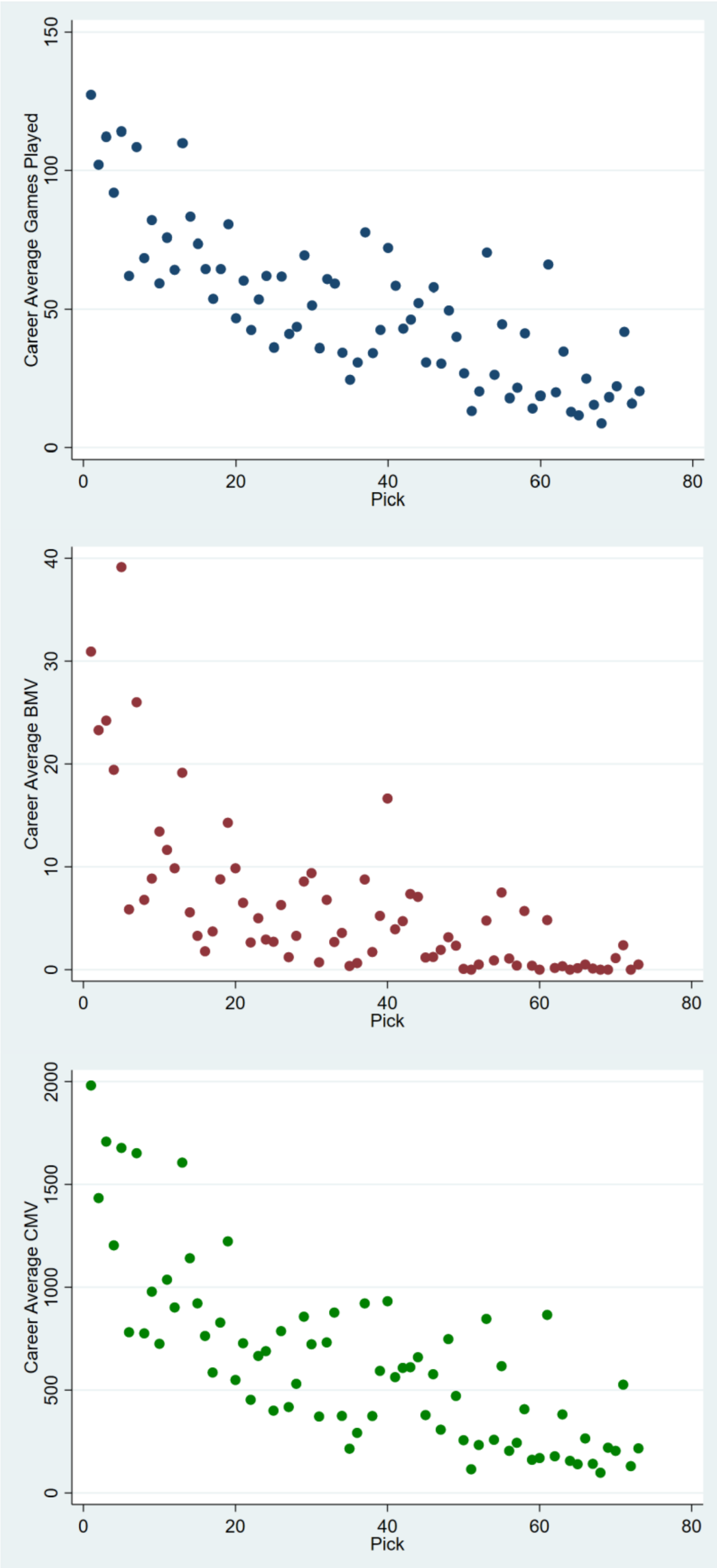
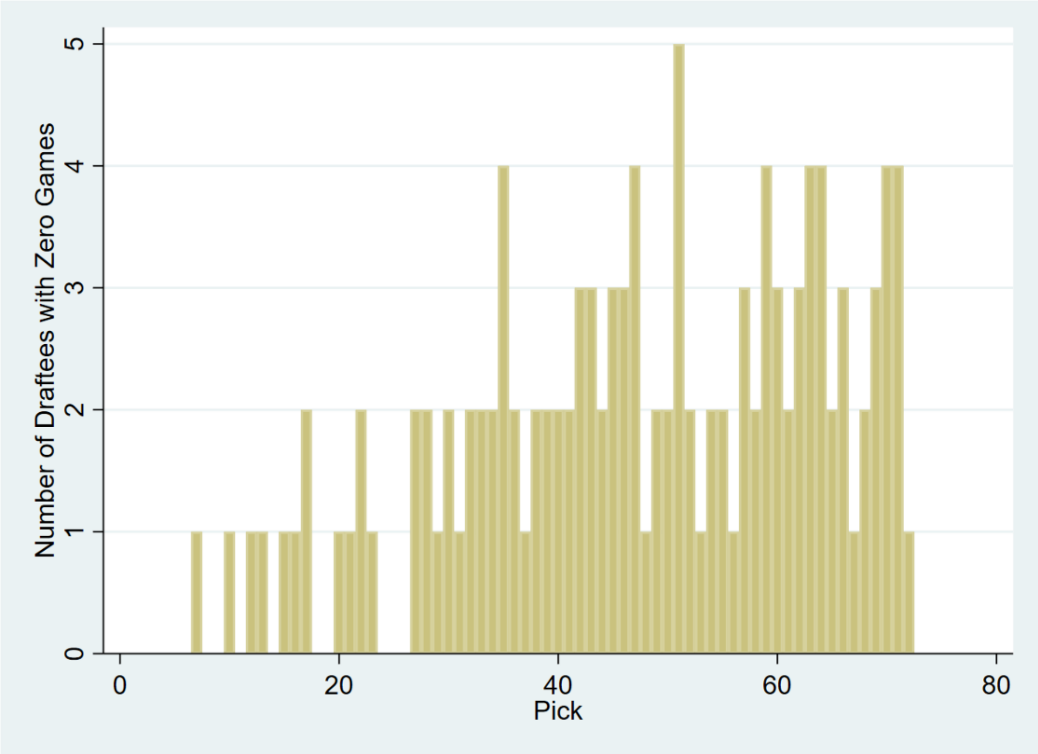


Figure 4.2: Dispersion of draftees who did not play in the AFL and their associated draft pick



Upon reviewing the listing statistics in Table 4.3, almost all draftees were listed in the first two seasons, in line with the length of their initial player contracts (AFL, 2017). However, the conversion of draftees who actually played, against those who were listed, trends above 80% from the third season onwards, upon the expiry of the initial contract, as teams only keep those with promising prospects within their ranks (Chandrakumaran, Larkin, et al., 2023). This is further reflected by the rise in the performance metrics from the third season onwards (games played, BMV, CMV). However, when reviewing the performance (in terms of CMV) within the first three seasons, each year a player's performance increases by a factor of their first season, further warranting the need for this study to quantify the delay in materialising the benefit of drafting a player. This delay is thereby estimated using two models in the following sections.

Based on the differing value inferred per pick by teams, it is reasonable to hypothesize that any proposed discount rate should also vary per pick as the expectations in terms of performance differs with the progression of the draft. Moreover, as the actual performance of draftees deviates considerably amongst later selections (as referenced in Figure 4.2 and in Tuck and Richards (2019), where the difference between the fifth percentile and median performance per pick grew with higher picks), it is also reasonable to assume that this discount rate would decrease as the risk is already factored in to the value of the pick, creating the basis for the models discussed hereon.

4.2.2 First Season as a Percentage of Overall Career Performance

This section uses a three-step procedure to obtain an estimate of a discount function. First, define a new dependent variable which can used a proxy to quantify the delay. Next, an empirical model is specified to find the determinants (other than draft pick number) of player performance. The third step involves fitting the relationship estimated previously with the associated draft picks to create the discount function.

Before defining the parameters for this model, the dependent performance metrics were repurposed to calculate a draftee's percentage contribution in their first season as a product of their career. That is, if a draftee played 10 games in their first season and 100 games in their career, the new dependant variable would attribute a value of 10% (the same was done for the other metrics, BMV and CMV). Similarly, if a draftee had not yet played a game within the sample range, the dependent variable would be 0.

A linear regression model with fixed effects for the drafting year was estimated (bounded generalized linear models yielded similar outcomes) using the independent variables outlined in Table 4.1 for each of the three-performance metrics (derivatives of the dependent variables). The sample was further curtailed to only include draftees who could have played more than two seasons (as a draftee's contribution to their team usually begins from their third season (Motomura et al., 2016), i.e., draftees selected between 2003 and 2014). This allowed us to negate the effects of draftees still in their initial contracts as shown in Table 4.3. The age when drafted, height, and weight together with indicator variables for race, position played, drafting team, and amateur league were used as the determinants (in line with Chandrakumaran (2021) and Stewart et al. (2016)). Furthermore, indicators for draftees selected using specialist picks (i.e., Father-Son (F/S) and Club-Academy (C/A)) were included to the list of determinants broken up based on the rule changes within the sample period (refer to Table 4.1).

The results shown in Table 4.4 suggest that drafting age had a positive effect, as older recruits tend to have shorter careers than their younger counterparts. This in turn requires them to have more game time in their first season as their careers might be relatively smaller. Furthermore, draftees selected by Carlton played 5% of their career in the first season. However, Gold Coast draftees reached up to 10%. This could be due to the fact that Gold Coast entered the league only in 2011, giving its players a shorter life span within the sample evaluated in this study. Furthermore, Gold Coast could have also utilised most of their new recruits to understand their potential as they might not have had veteran players within the squads at this time. C/A players recruited prior to 2015 showed similar results, which could be attributed to the same effect observed with Gold Coast as C/A was first introduced in 2011. The indigenous player indicator returned insignificant values in all models failing to materialise the performance anomalies observed in previous works in terms of game time (Mitchell et al., 2011) and BMV (Lenten, 2017). The models that were run as a check for robustness excluding those who did not play returned similar outcomes as the dispersion of players who did not play a game, though positively skewed, was evenly spread as shown in Figure 4.2.

Table 4.4: First season performance as a percentage of career model

Model Type	Linear Regression with Fixed Effects for Year Drafted					
Dependant Variable	First Season as a Percentage of Career					
	Games Played		BMV		CMV	
Model Number	(4.1)		(4.2)		(4.3)	
Independent Variables	Coefficient	Robust Std. Err.	Coefficient	Robust Std. Err.	Coefficient	Robust Std. Err.
Drafting Age	0.03***	0.01	0.02*	0.01	0.03***	0.01
Club academy (C/A)						
≤ 2014	0.19***	0.03	0.04**	0.02	0.18***	0.06
Father–son (F/S)						
≤ 2006	0.03**	0.01	-0.01	0.01	0.04*	0.02
2007 ≤ 2014	-0.01	0.04	-0.03	0.01	-0.03	0.03
Indigenous	0.06*	0.03	0.01	0.02	0.05*	0.03
Weight	-0.01***	0.01	0.09	0.01	-0.01***	0.01
Height	0.01*	0.01	-0.01	0.01	0.01	0.01
Position Played [a]						
Forward	0.04*	0.02	-0.02	0.01	0.04*	0.02
Midfielder	0.01	0.01	0.01	0.01	-0.01	0.02
Ruckman	0.02	0.02	-0.02	0.02	0.03	0.02
Drafting Team [b]						
Brisbane	0.03	0.05	0.04	0.02	0.04	0.04
Carlton	0.06**	0.02	0.03	0.02	0.06***	0.02
Collingwood	0.05	0.04	0.05	0.03	0.05	0.04
Essendon	0.03	0.03	0.02	0.01	0.01	0.03
Fremantle	0.06	0.05	0.08	0.05	0.08	0.06
Geelong	-0.01	0.04	0.01	0.01	0.01	0.03

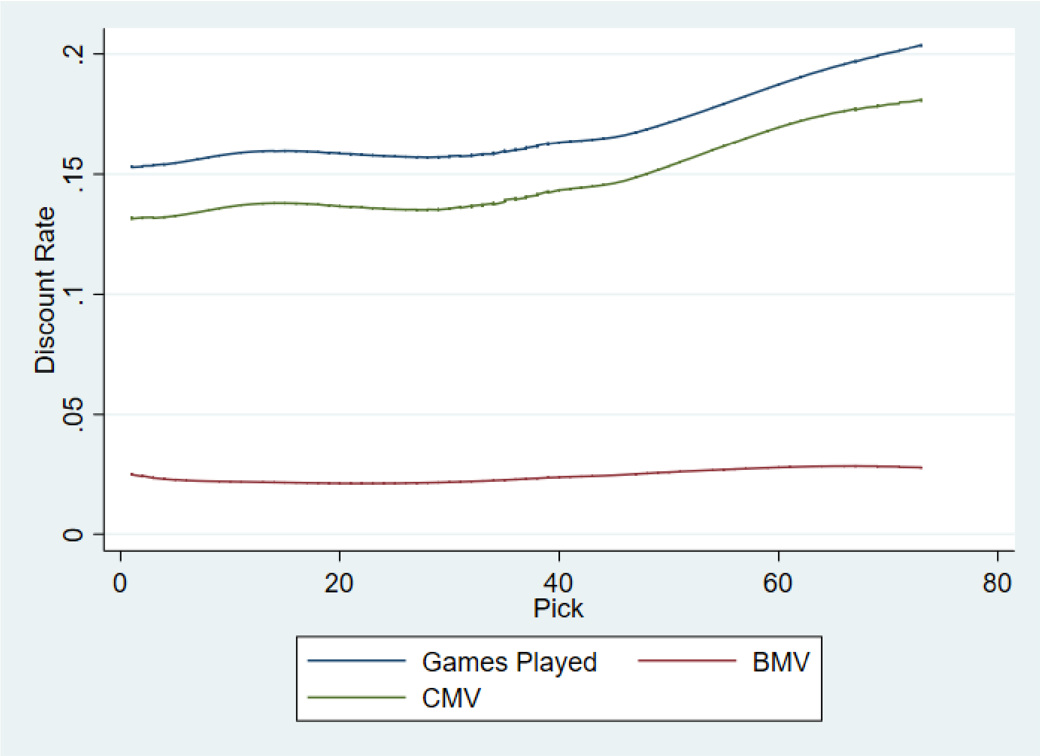
Gold Coast	0.10**	0.04	0.02*	0.01	0.11**	0.04
Greater Western Sydney	0.01	0.04	0.04*	0.02	-0.01	0.04
Hawthorn	-0.01	0.04	0.01	0.01	-0.01	0.04
Melbourne	0.05	0.04	0.04	0.02	0.04	0.04
North Melbourne	0.01	0.03	0.01	0.01	-0.01	0.02
Port Adelaide	0.01	0.03	0.01	0.01	0.01	0.02
Richmond	0.07*	0.03	0.03	0.02	0.06	0.04
St. Kilda	0.07	0.07	0.04	0.02	0.05	0.07
Sydney	-0.02	0.03	0.06*	0.03	-0.02	0.03
Westcoast	0.07	0.05	0.04	0.02	0.08	0.04
Western Bulldogs	0.03	0.05	0.02**	0.01	0.04	0.05
Amateur League [c]						
SANFL	0.01	0.03	0.05*	0.02	0.02	0.03
TAC Cup	0.03	0.03	0.03*	0.01	0.04	0.03
WAFL	0.01	0.02	0.04*	0.01	0.01	0.02
Constant	-0.52**	0.18	-0.39	0.24	-0.56**	0.19
Observations	689		689		689	
Listed Players Drafted Between	2003-14		2003-14		2003-14	
R-squared	0.16		0.06		0.15	
Prob(F-Statistic)	0.00		0.00		0.00	

[a] the reference position is Defender; [b] the reference team is Adelaide Crows; [c] the reference league is Other.

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

In order to the create the discount function, the expected outcomes of the previous model for all three-performance metrics were then fitted against pick number using a locally weighted scatterplot smoothing (LOWESS) curve, as shown in Figure 4.3 (the fitted plots including confidence intervals are available in Figures S4.4, S4.5 and S4.6). The fitted games played function suggests that a draftee selected using pick one would be expected to play approximately 10% of the career games within their first season. This could be used as a proxy to discount future picks, where pick one from next year's draft would be worth 10% less than its value today. Though the first hypothesis of a varying discount function was upheld, the rate seemed to increase with the draft. This could be due to the shorter careers of players selected at the tail end of the draft, increasing the proportion of game time they have in their first season compared to their overall careers. Individually the BMV function ranged between 2% and 4%, as they are awarded by on field umpires unlike games played or CMV and is subject to their own prejudices. Yet, the games played and CMV functions ran parallel to each other between 7% and 13%. However, the manner in which the CMV function lies below games played suggests that even if a recruit is on field, their effective contribution to a team might not necessarily correlate to their time (Gogos et al., 2020), warranting a different approach to quantify this delay and create a more representative discount function.

Figure 4.3: Predicted discount rate as outlined by the first season performance of a draftee as a percentage of career performance per pick



4.2.3 Difference between Seasonal and Career Average Performance per Game

Whilst the previous model provides an understanding of how a discount function should look and the preference to use CMV derived metrics as opposed to games played and BMV, the results obtained were impacted by two key issues. First, the variation in career lengths across picks adversely affects latter selections as it increases their proportion of early career outcomes. Secondly, a player's contribution in their first season might not necessarily have the same effect as their contribution later on in their careers. Hence, it is equally important to understand the returns expected within the context of a team. The performance derivatives used in Table 4.4, though illustrate the expected outcomes of a draftee in their first season when compared to their potential career, it does not articulate the need of the team.

Assuming that all teams aim to maximize wins (or aspire to build a team capable of delivering this outcome), a draftee's potential to the roster is to consistently contribute to that effort. Hence, the derivative of the dependent variable used within the second model is the percentage difference between the draftee's CMV in their first season and their career average throughout per game, thereby negating the career length effect and elevating the effectiveness of outcomes issue observed in the previous model. For example, if a draftee contributes six points to the margin of victory per game in their first season, and their career average contribution per game is 10, the new metric will assume a value of 40% ((10-6)/10). This essentially answers the question of discount in the team's purview as it accounts for the time taken by the draftee to achieve the highest CMV per game. Table 4.5 furnishes the regression results of this new metric controlled for the effects as in the previous models.

The results in model 4.4 suggest the difference between a draftee's first season average CMV per game and their overall career reduced by 7% as they get older. As mature players might have had more experience in other minor leagues, they might contribute more than their peers who are relatively young. Some drafting team indicators returned significant coefficients as well. For example, the difference between first season and career CMV per game for Fremantle draftees was 29% less when compared to the reference team of Adelaide, as they were exposed to more game time early on in their careers. The same effect was also observable amongst some other clubs, including Gold Coast which was one of only two examples in the previous model. When the model was repeated to predict the percentage difference between second (4.5), third (4.6), and fourth (4.7) season and career average CMV per game, Fremantle's effect withered down as expected. Ideally a team would only retain players which it deems to effectively contribute to its ability to maximise wins. The significant coefficient for C/A observed in 4.5 could be attributed to the same effect observed in Table 4.4, as the career lengths of such draftees remains relatively shorter.

Table 4.5: Percentage difference between specific seasons and career average CMV per game model

Model Type	Linear Regression with Fixed Effects for Year Drafted							
Dependant Variable	Percentage Difference Between First Season and Career Average CMV per Game		Percentage Difference Between Second Season and Career Average CMV per Game		Percentage Difference Between Third Season and Career Average CMV per Game		Percentage Difference Between Fourth Season and Career Average CMV per Game	
Model Number	(4.4)		(4.5)		(4.6)		(4.7)	
Independent Variables	Coefficient	Robust Std. Err.	Coefficient	Robust Std. Err.	Coefficient	Robust Std. Err	Coefficient	Robust Std. Err.
Drafting Age	-0.07***	0.02	-0.03**	0.01	-0.05**	0.02	-0.04**	0.01
Club academy								
≤ 2014	-0.18	0.12	-0.51***	0.07				
Father–son								
≤ 2006	0.01	0.14	-0.06	0.09	-0.12*	0.06	-0.07	0.07
2007 ≤ 2014	0.09	0.14	-0.04	0.12	-0.05	0.10	-0.01	0.06
Indigenous	-0.08	0.08	-0.11	0.08	-0.06	0.05	-0.06	0.07
Weight	0.01	0.01	0.01	0.01	0.01*	0.01	-0.01	0.01
Height	-0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Position Played [a]								
Forward	-0.07*	0.04	0.03	0.05	-0.01	0.04	-0.01	0.05
Midfielder	-0.05	0.04	-0.01	0.05	0.01	0.03	-0.01	0.04
Ruckman	-0.02	0.06	-0.12	0.08	0.05	0.07	0.08	0.13
Drafting Team [b]								
Brisbane	-0.36***	0.10	-0.29***	0.08	-0.21**	0.08	-0.15	0.10
Carlton	-0.26**	0.09	-0.18*	0.09	-0.34***	0.09	-0.16	0.11
Collingwood	-0.17	0.10	-0.25**	0.10	-0.19**	0.08	-0.07	0.08

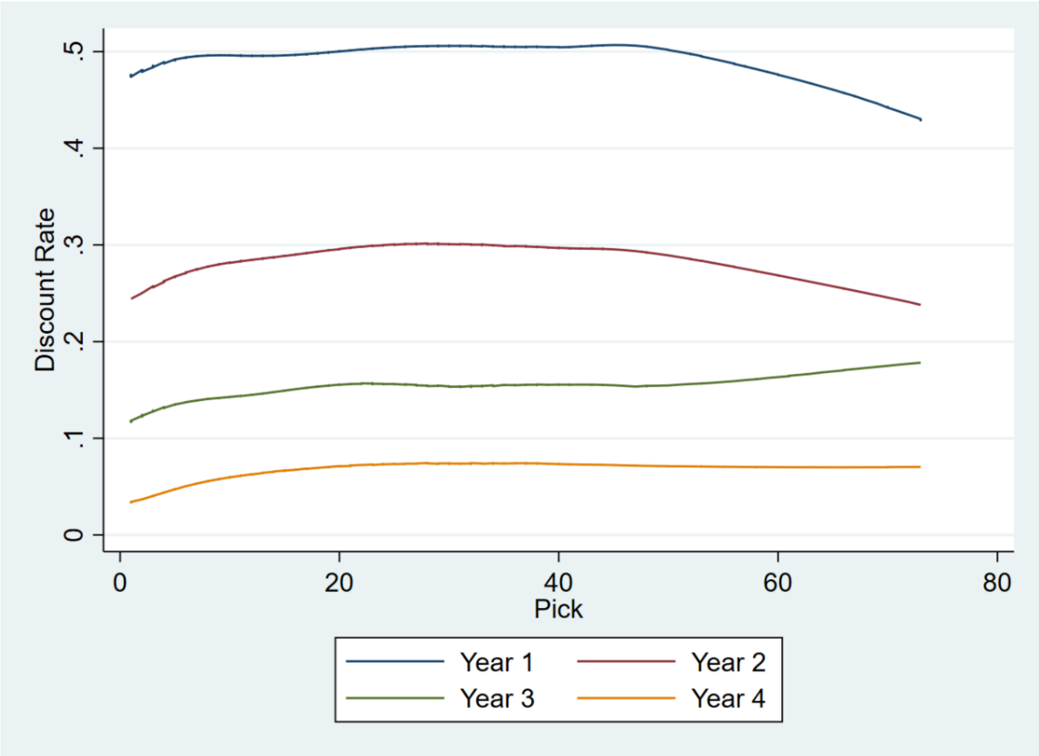
Essendon	-0.25**	0.09	-0.31***	0.04	-0.15	0.12	-0.17**	0.06
Fremantle	-0.29**	0.11	-0.19**	0.06	-0.15	0.12	-0.03	0.07
Geelong	-0.01	0.07	0.02	0.09	-0.15	0.09	0.05	0.06
Gold Coast	-0.41***	0.08	-0.22**	0.08	-0.28**	0.12	-0.31***	0.04
Greater Western Sydney	-0.27**	0.11	-0.36***	0.07	-0.28***	0.08	-0.10	0.06
Hawthorn	-0.03	0.10	-0.05	0.08	0.03	0.15	-0.05	0.09
Melbourne	-0.15*	0.08	-0.27***	0.06	-0.23*	0.11	-0.14	0.08
North Melbourne	-0.13	0.11	-0.15*	0.07	-0.20**	0.08	-0.09	0.10
Port Adelaide	-0.07	0.08	-0.12	0.09	-0.08	0.08	-0.10*	0.05
Richmond	-0.18*	0.09	-0.23**	0.08	-0.08	0.08	-0.13	0.09
St. Kilda	-0.19	0.11	-0.24**	0.08	-0.12	0.13	-0.09	0.07
Sydney	-0.06	0.12	0.028	0.10	0.11	0.13	0.01	0.11
Westcoast	-0.21*	0.08	-0.17*	0.08	-0.24***	0.07	-0.13	0.09
Western Bulldogs	-0.16	0.12	-0.17*	0.08	-0.16	0.11	-0.14*	0.07
Amateur League [c]								
SANFL	-0.07	0.05	0.12*	0.06	0.03	0.07	0.07	0.06
TAC Cup	-0.03	0.08	0.09*	0.05	-0.03	0.05	0.03	0.03
WAFL	0.03	0.07	0.16*	0.06	0.08	0.06	0.06	0.04
Constant	1.30	0.86	-0.70	0.64	-0.38	1.00	0.65	0.91
Draftees	689		573		451		370	
Listed Players Drafted between	2003-14		2003-13		2003-12		2003-11	
R-squared	0.12		0.14		0.18		0.08	
Prob(F-Statistic)	0.00		0.00		0.00		0.00	

[a] the reference position is Defender; [b] the reference team is Adelaide Crows; [c] the reference league is Other.

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

In order to create the new discount function, the expected values from models 4.4 to 4.7 were used to fit a LOWESS curve in Figure 4.4 (the numerical values are available in Table S4.2; the fitted plots including confidence intervals are available in Figures S4.7, S4.8, S4.9 and S4.10), with the discount rates hovering between 42% and 51%. For example, assuming pick one is equal to 100 points today, the same selection from next year's draft would be worth 53 today (100*(1-0.47)). Unlike the previous models, the discount function derived here follows a somewhat concave curve, as opposed to the monotonically increasing versions. There is a slight increase observed amongst the initial picks, which could be the result of sunk investment plays (Staw & Hoang, 1995) whereby decision makers tend to provide more on field time to recruits drafted early on, even when their on-field performance did not warrant that decision (similar to an investor riding losing investments and dumping winners (Kahneman & Tversky, 1979)). More game time translates to quicker personal development, which in turn reduced their time to develop over their careers. Hence their average CMV per game in the first season might appear to be lesser than their inflated career potential. This further coincides with the suggestion that decision makers overvalue the initial picks in the draft (Chandrakumaran, 2021) and retain these players beyond their marginal productivity levels (Borland et al., 2011; Chandrakumaran et al., 2024a). However, the discount function seems to increase in middle of the draft (between picks 20 and 40), contradicting our previous hypothesis. Previous studies have shown that picks from the middle of the draft are exchanged more frequently than both tail ends. This leads to the same escalation effects made evident with earlier picks, without the developmental uptick (Chandrakumaran, Larkin, et al., 2023; Chandrakumaran et al., 2024a) and larger dispersions in performance which in turn increases the discount rates. In the tail end of the draft, the discount rate declines again. This could either suggest that some talent is overlooked in the drafting process till later on (as suggested by the trend line in Figure 4.2, with sporadic observations of draftees denied any game time if they were picked early), or the shorter career lengths of later draftees puts their first season CMV per game to be more in par with their overall careers. The discount rate functions for years 2 and 4 followed a similar trend, whilst year three increased with the progression of the draft. After the end of the initial contract (at the end of year two), teams are most likely to retain players who align with their overall objectives in the long run. Unless tail end draftees show any potential, they might get delisted in this time and their outcomes within the team might be adversely skewed increasing their discount rate. When comparing the discount rates year-on-year, it is evident that the point-to-point difference between them reduced with each year as their experience grows.

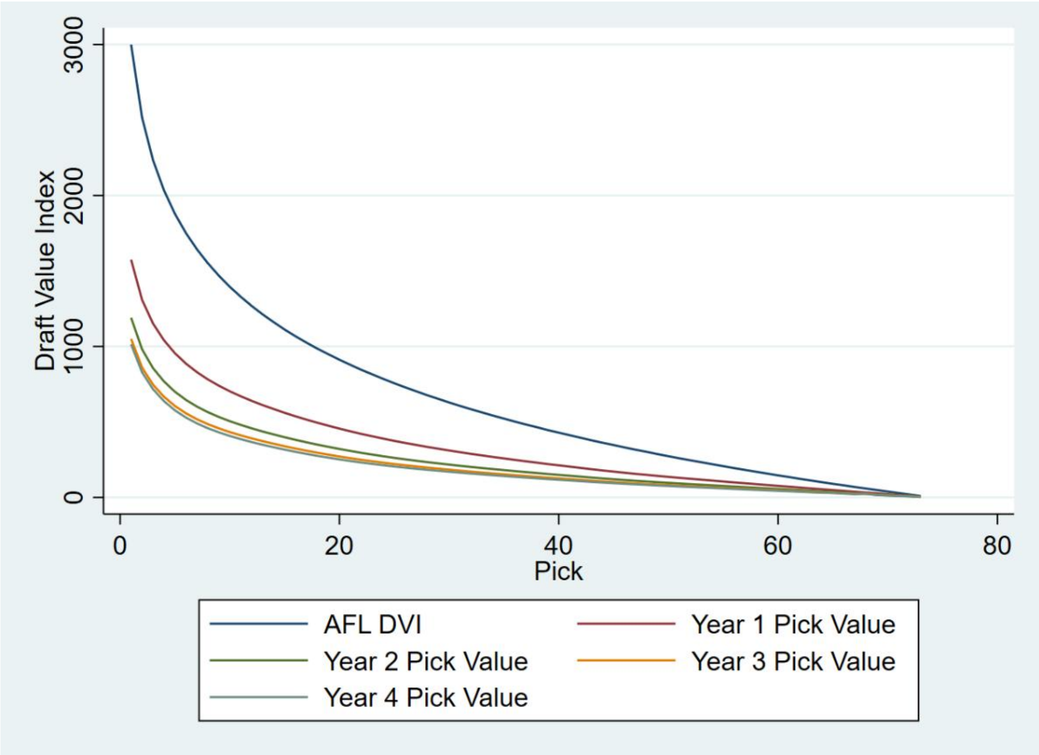
Figure 4.4: Expected percentage difference between specific seasons and career average CMV per game per pick



4.2.4 Pick Value & Application

In order to overlay the discount functions estimated in the previous section, we chose the AFL's Draft Value Index (DVI, (AFL, 2015a)) as the basis for the value of a pick in the current year. This index and the respective values each year in the future was obtained by applying the discount rates presented in Table S4.2 and plotted in Figure 4.5 (the numerical values are available in Table S4.3). Given the curvature of both the pick value and discount rate functions, the value of future picks loosely translated to varying picks in the current year. For example, the first pick next year was approximately equal to pick 8 in the current year, while pick one from year three matched pick 14 from the current year. Interestingly, the variance in pick value observed between the first and last selection reduced each year as only the best players would remain listed after their initial contract period.

Figure 4.5: Current AFL DVI and discounted future pick value



In order to gauge the effectiveness of the proposed method, a pick swap between Hawthorn and St Kilda in 2016 has been presented in Table 4.6. In return for picks 10 and 68 of the 2016 draft, Hawthorn released picks 23 and 26 together with their first-round selection from 2017 to St Kilda. Without the proposed discount model, assuming that the teams use the same pick value method and expect parity in exchange (as done in previous studies (Massey & Thaler, 2013; Taylor et al., 2018), where both teams exchange value that is equal, making no profit off one another and the total difference is attributed to the single future year pick in the trade), Hawthorn's 2017 first round pick would be valued at 137 (1,395 + 59 – 815 – 502). Since, Hawthorn would not know their 2017 draft position in 2016 (eventually this was pick seven), this first round pick could lie anywhere between one and 18. If this is assumed to be pick one, for the trade to be equal, Hawthorn would have discounted this pick by 95.43% (1-137/3,000). Even at the last spot in round one (pick 18), the selection would need to be discounted by 86.09% (1-

137/985) for the trade to be equal. However, through the discount rates introduced in this study, we could clearly understand that St Kilda made a profit (previously alluded to as implied discount in full) by deferring their right to choose in the current year, as the lowest value for next year's round one pick (pick 18) is 494, which is higher than the difference of 137 mentioned earlier. This profit could be attributed to both, Hawthorn's need for trading up and getting pick 10, as they may have endeavoured to use said selection to select an amateur player who was possibly in the prospective lists of multiple teams and their inability to predict their future standing (and by extension their position in next year's draft).

Table 4.6: 2016 Trade between Hawthorn and St Kilda

Hawthorn received picks		
10	1,395	
68	59	
	1,454	
St Kilda received picks		
23	815	
36	502	
	1,317	
Difference	**137**	2017 Hawthorn Round 1 (St Kilda Received)

Pick	*Current DVI*	*Discount Rate (1-137/Current DVI)*	*Proposed Year One DVI*	*Proposed Discount Rates*
1	3,000	95.43%	1,575	47.49%
2	2,517	94.56%	1,309	47.99%
3	2,234	93.87%	1,152	48.45%
4	2,034	93.26%	1,041	48.83%
5	1,878	92.71%	955	49.15%
6	1,751	92.18%	886	49.38%
7	1,644	91.67%	830	49.52%
8	1,551	91.17%	782	49.60%
9	1,469	90.67%	740	49.62%
10	1,395	90.18%	703	49.61%
11	1,329	89.69%	670	49.59%
12	1,268	89.20%	639	49.57%
13	1,212	88.70%	611	49.56%
14	1,161	88.20%	585	49.57%
15	1,112	87.68%	560	49.61%
16	1,067	87.16%	537	49.66%

17	1,025	86.63%	515	49.73%
18	985	86.09%	494	49.82%

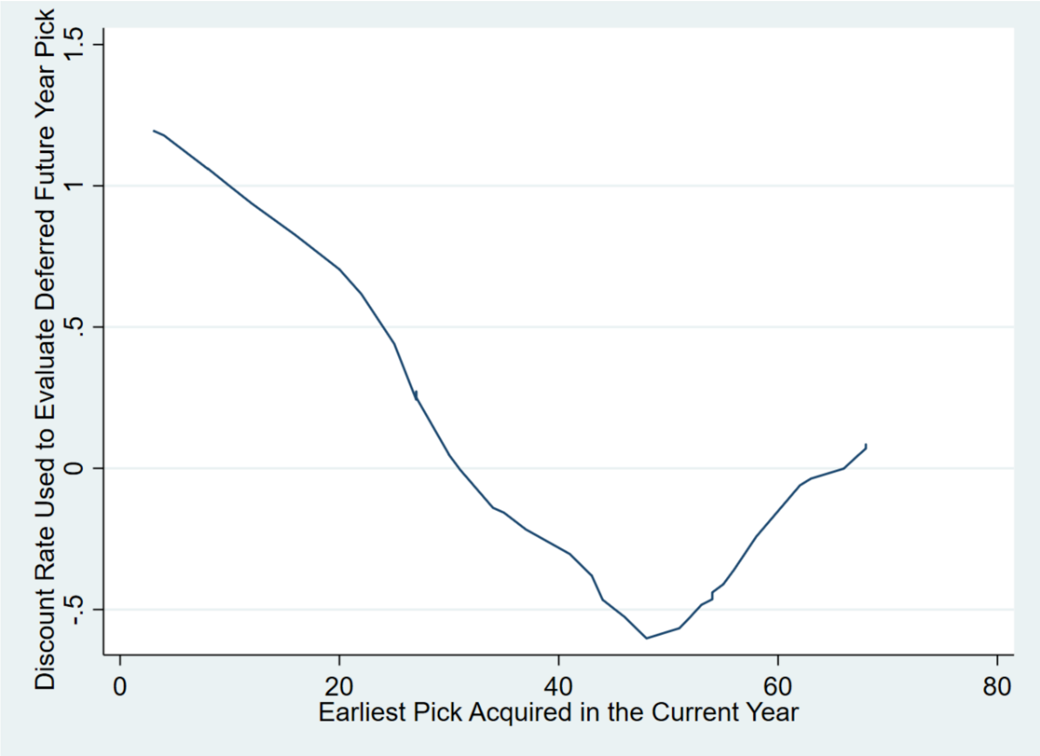
4.3 Discussion

Trading picks is a common transaction observed in sporting leagues that employ player drafts (Maxcy, 2012). However, many current and revised draft formats employed by professional leagues allow for the trading of picks in the current year for those in the future (Bowen, 2015; Gleeson et al., 2015). This raises a question of an appropriate rate of discount which can be used to account for the delay in relinquishing current picks for those in the future. Using the difference between a draftee's contribution to a team in their first season (second, third and fourth season for the subsequent discount rates) when compared to their overall career, this study created a discount rate function that can be used by decision makers within clubs to potentially evaluate trades involving draft picks from the future.

Referring back to the example put forward in the introduction, if team A wished to obtain team B's fifth pick in the current year (valued at 1,878), they would need to release their pick nine in the current year (valued at 1,469) together with their first-round pick from the next year. At best, if team A finishes last in the ladder this year and obtain pick one next year, team B will make a significant profit of 1,166 DVI points in the trade (1,575 (pick one next year) + 1,469 – 1,878) and at worst, breakeven with a slight margin of 85 (494 (pick 18 next year) + 1,469 – 1,878). Whilst the proposed metric might not necessarily allow teams to understand the exact value exchanged in each trade at the time it was executed due to the inability to predict next year's drafting order, it would allow them to hedge themselves according to their risk tolerances. Going back to the previous example, if team B was content with breaking even (not making a profit) on the trade, team A could forgo its second-round pick from next year instead of its first-round pick. However, this pick has to be between 19 and 23 (i.e., team A has to be placed between 14 and 18 in the ladder next year) for team B to breakeven as any lower could put it in a net negative. Though this could be achievable based on a number of factors, team B might not be willing to risk it and would ideally prefer a first-round pick to guarantee a net positive result.

Another aspect motivating teams when evaluating trades is the urgency of the earliest pick to the team trading up (giving up later picks for the early selection). As mentioned in the previous section with the Hawthorn-St Kilda example, it is clearly visible that St Kilda made a profit in this trade by trading down (obtaining later selections in the 2016 draft and a deferred choice in the 2017 lineup). However, Hawthorn's motivations to give up this profit could be due to their want to secure a key player using pick 10. Using all the trade data available between 2015 and 2016 where a selection of current year picks was exchanged together with one future year selection, Figure 4.6 plotted a LOWESS function between the implied discount rate (where the trade is expected to be equal) attributed to the future pick and the earliest selection in the trade. For example, to represent Port Adelaide receiving pick 12 in the 2021 draft, by releasing pick 14 and their second-round pick from 2022 to West Coast, the figure would create plot against pick 12 in the horizontal axis (as it is the earliest selection). For the vertical axis, the difference of 107 (1,268 – 1,161) between picks 12 and 14 would then be compared against the value of pick 28 (677 in the DVI), which is the expected second-round pick of Port Adelaide in 2022 (as per www.draftguru.com). This would amount to 84% (1-(107/677)). With previous studies suggesting trading down (giving up early picks for a few later on) creates opportunities for arbitrage as teams over value early selections (Chandrakumaran, 2021; Massey & Thaler, 2013), the behaviour observed in the AFL future pick trading market also validated this argument. Should teams opt to heavily discount future picks to trade up to the current year, decision makers could create an opportunity for arbitrage by deferring their picks (which is essentially another form of trading down). The trend observed in Figure 4.6 further supplemented the proposition made by the previous authors. Essentially a team with a prospect of obtaining the first pick in a trade could discount a future pick, that it could relinquish as part of the negotiation, by up to 120%. This clearly portrays the team's need for instant gratification over deferred options (DellaVigna & Malmendier, 2004; DellaVigna & Paserman, 2005; O'Donoghue & Rabin, 1999), 'because the present is valued discretely more than the future' (Harris & Laibson, 2013). However, this rate declines and goes into the negative as the earliest pick in a trade reaches 30, whereby managers hedge their bets in seeking out better talent options in the future.

Figure 4.6: Discount rate used to evaluate deferred future picks plotted against the earliest pick acquired today in single future pick trades between 2015 and 2022



4.4 Limitations

Whilst this study provides decision makers with a discount rate which could be potentially used to evaluate trades involving future picks, the functions themselves were based on derivatives of performance (percentage difference between specific seasons and career average CMV per game). These performance derivatives could be influenced by a variety of factors, including but not limited to, a player's physical structure, position played, amateur league experience, race, drafting team, injury periods, movements between rookie and senior lists, and player trades (Chandrakumaran, 2021; Chandrakumaran, Stewart, et al., 2023). Though the predicted estimates used to fit the LOWESS function controls for a few of these factors, it is reasonable to assume that these might not be fully eliminated. Coupled with the escalation effects discussed early on, the deviation of the discount rate per pick from the mean could be influenced by factors not necessarily related to player performance. Whilst the proposed discount rates are derived on expected performance, they have been overlaid on the AFL DVI to project future values of draft picks. If this is replaced with a different value function such as those available in the current literature, the basis of analysis would shift leading to different outcomes. Furthermore, the inability to predict future draft order makes teams that forgo current picks in return for future ones err on the side of caution and hedge their bets. This could explain the reliance of decision makers on market rates to evaluate trades (for both current and future exchanges) even though the current literature hosts a variety of works valuing picks based on player performance (Chandrakumaran, 2022; Chandrakumaran, Stewart, et al., 2023; Schuckers, 2011a, 2011b).

4.5 Conclusion

Evaluating multi-year investment propositions is an arduous task, especially when the returns are of a non-monetary nature. Yet such decisions are entertained by list managers in many professional sporting leagues with restrictive labour markets. Though player drafts are intended to disperse amateur talent equitably, it creates a broad range of alternative outcomes that ought to be evaluated on its own merits. One such alternative is the right to defer or advance your draft pick through trades.

Ideally, for trades to always have parity in exchange, accurate denominations of value are required. Whilst the prevailing literature provides alternative methods to value picks and players to evaluate such trades, the question of future selections remained unanswered. As the expected outcomes of draftees vary based on the pick used to recruit the player, this study proposed a discount rate function within the context of the AFL. By overlaying this into the AFL's DVI, it provides AFL clubs and list managers with a guideline in evaluating trades involving future picks. The findings held the hypotheses of a variable discount rate that drops with the progression of the draft. Though the AFL only allows trading of picks up to one year in the future (to be increased to two in 2025 (Twomey, 2024a), this model has shown its versatility to be retrofitted to the needs of other North American drafts which allows trades involving picks up to four years into the future.

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Supporting Information

Figure S4.1: Frequency of draftees per career games played interval

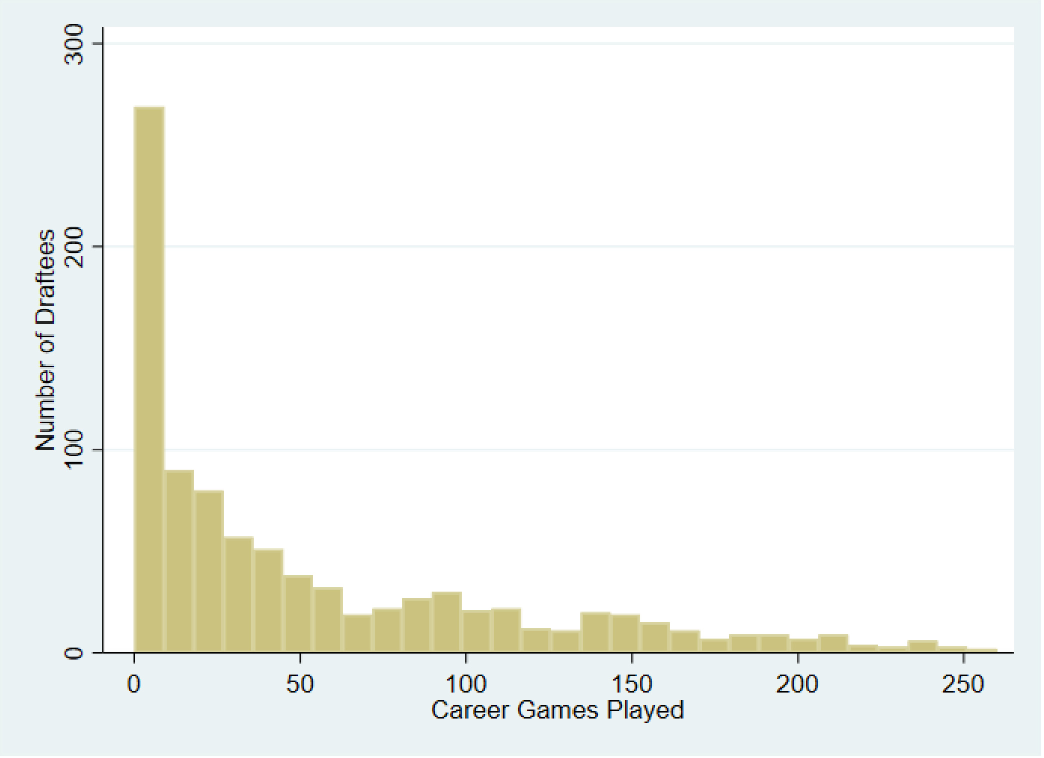

Figure S4.2: Frequency of draftees per career BMV interval

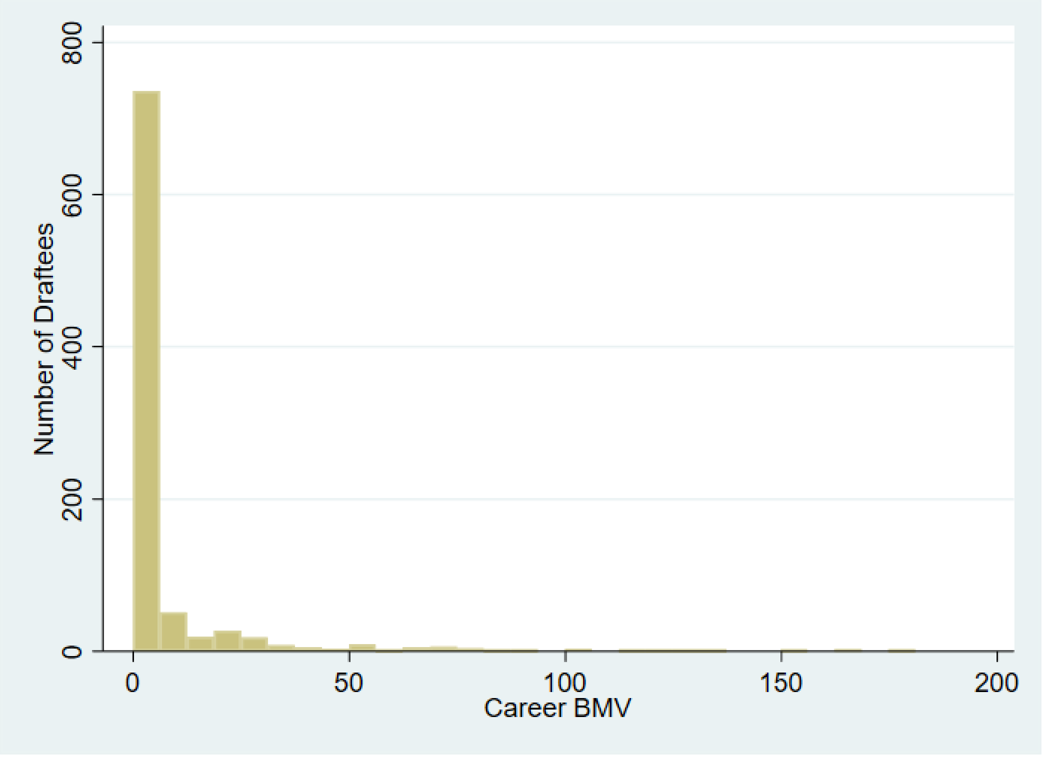

Figure S4.3: Frequency of draftees per career CMV interval

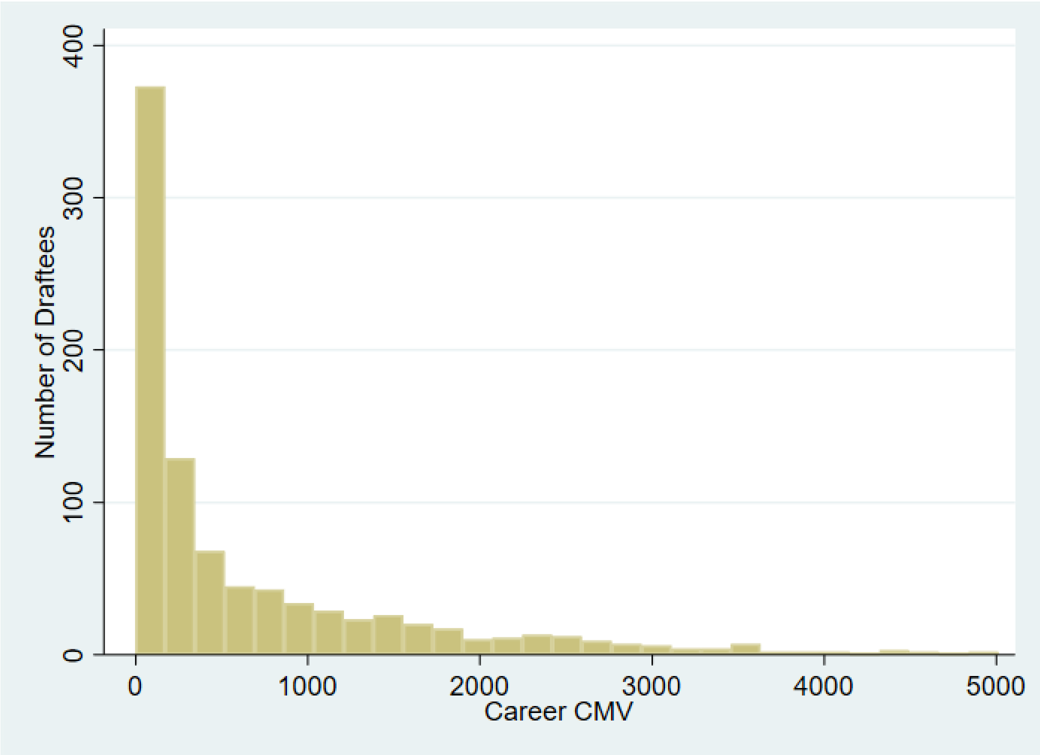

Figure S4.4: Fitted values from model (4.1) together with LOWESS

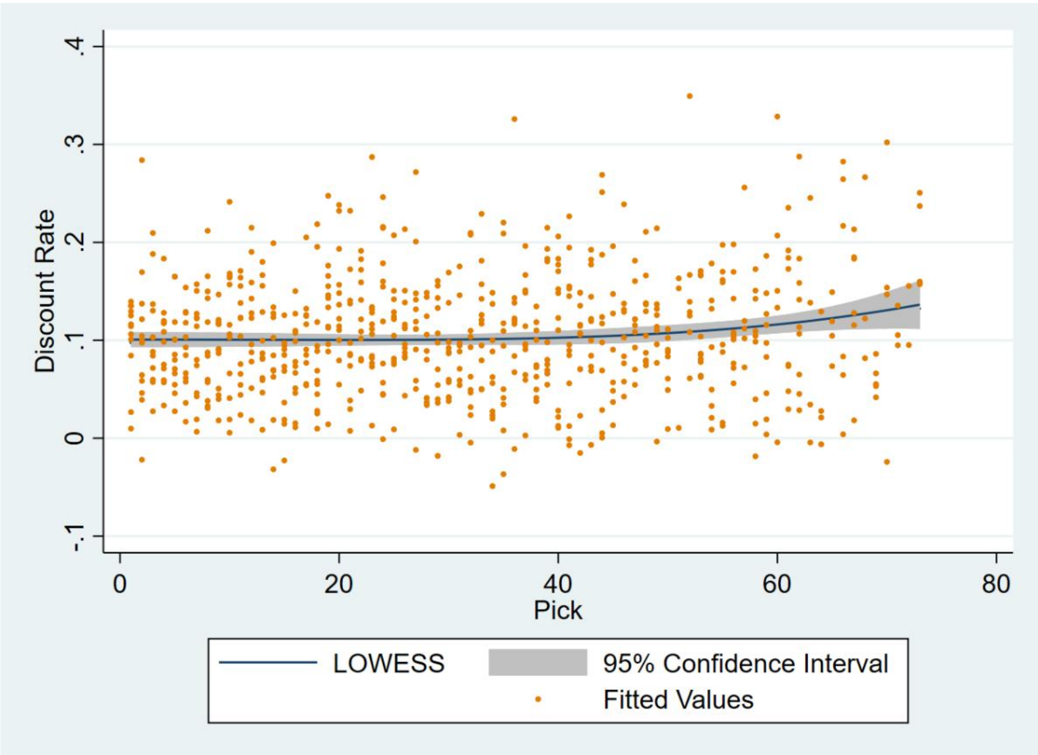

Figure S4.5: Fitted values from model (4.2) together with LOWESS

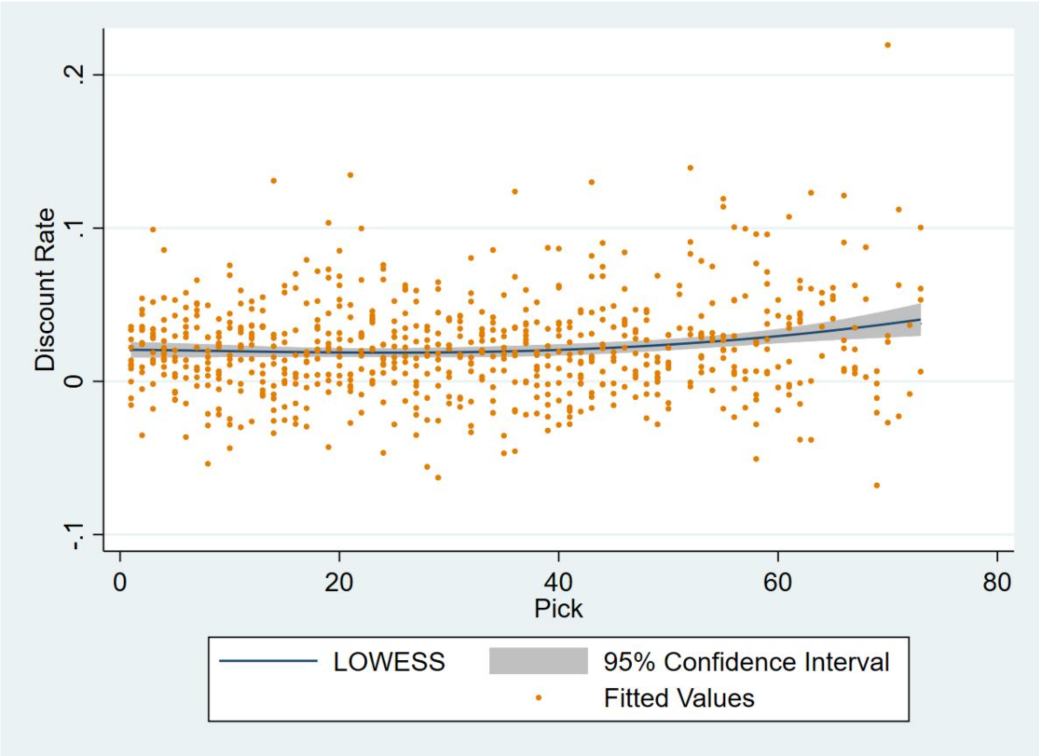

Figure S4.6: Fitted values from model (4.3) together with LOWESS

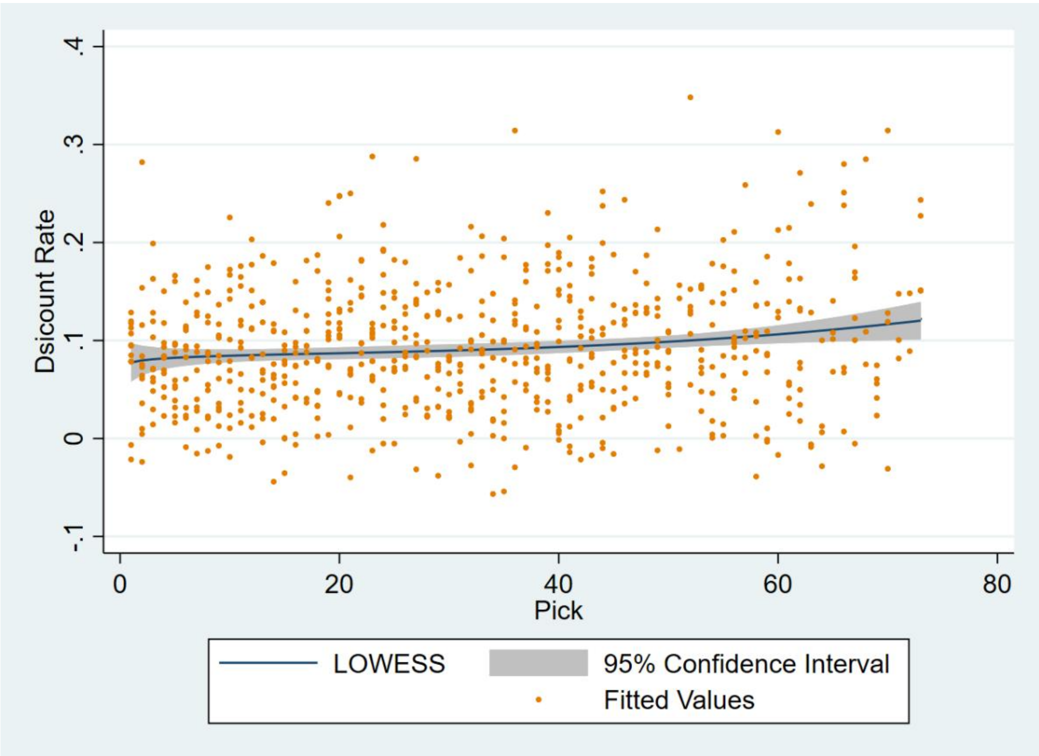

Figure S4.7: Fitted values from model (4.4) together with LOWESS

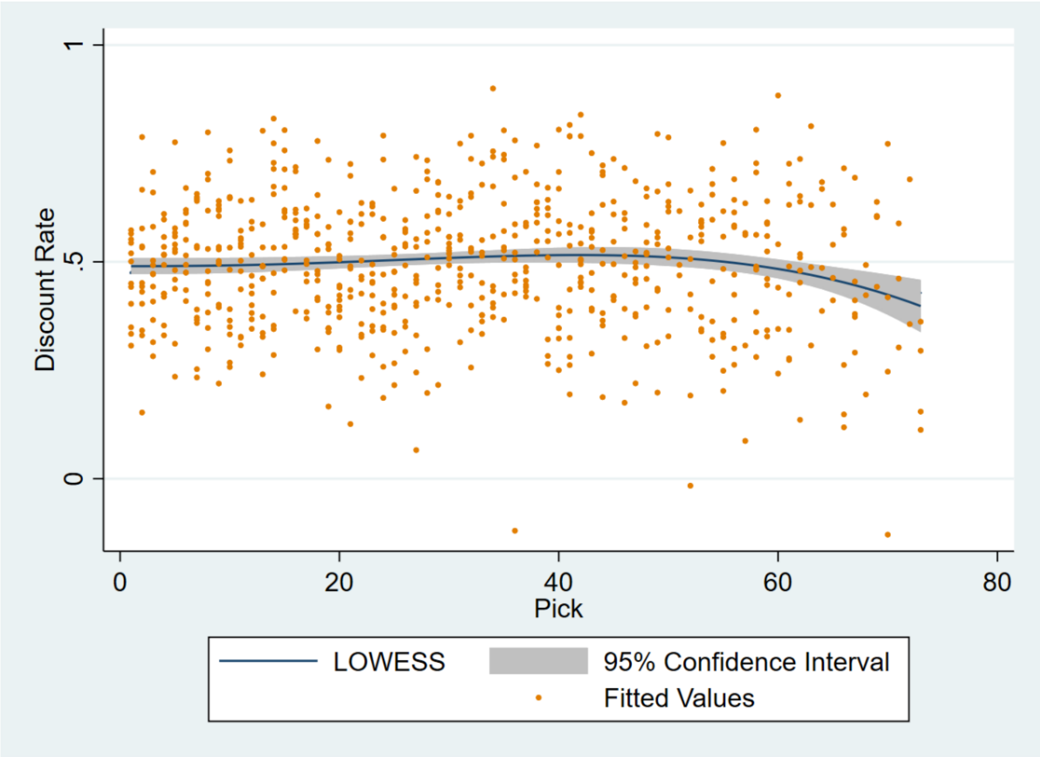

Figure S4.8: Fitted values from model (4.5) together with LOWESS

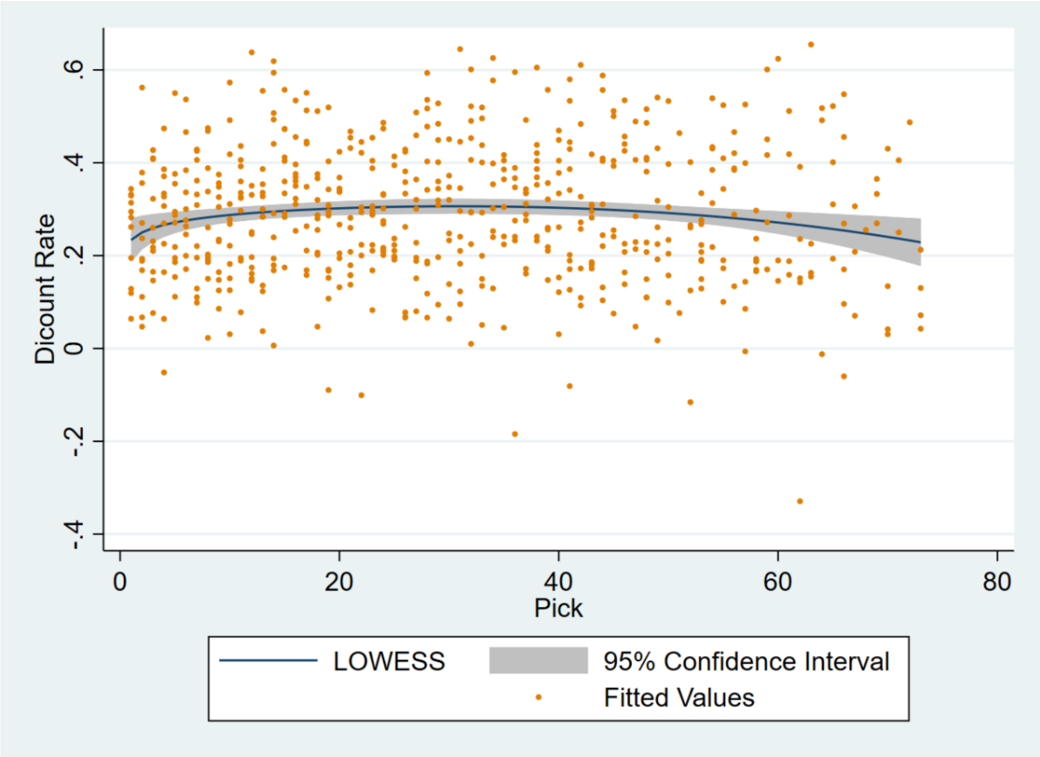

Figure S4.9: Fitted values from model (4.6) together with LOWESS

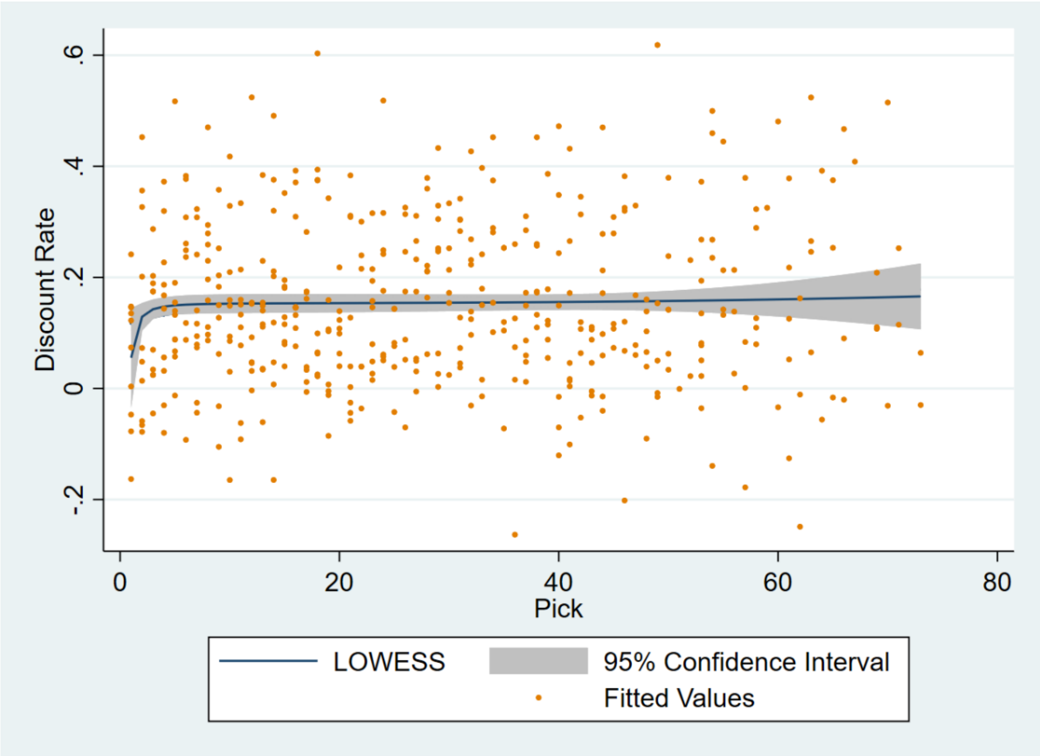

Figure S4.10: Fitted values from model (4.7) together with LOWESS

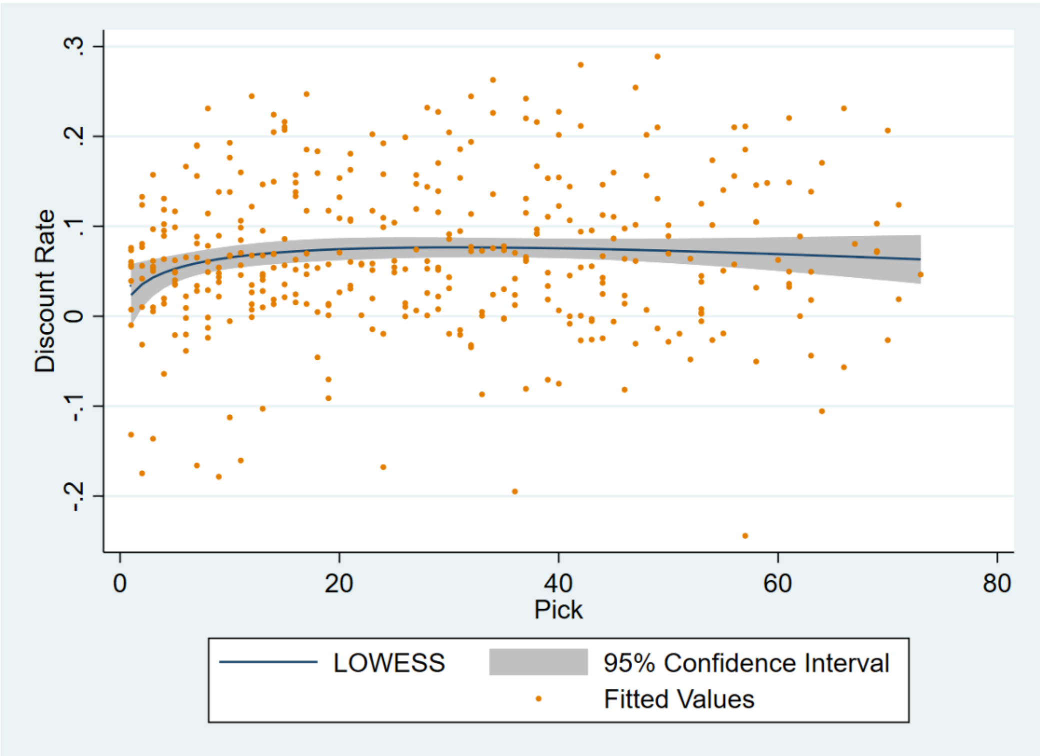

Table S4.1: CMV predictor

Model Variables	Ordinary Least Squares			
	Winning Team Margin of Victory			
	(4.8)		(4.9)	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Kicks	0.11***	0.02	0.11***	0.02
Marks	-0.08***	0.03	-0.08***	0.03
Contested Marks	0.32***	0.06	0.31***	0.05
Effective Possessions	-0.02*	0.01	-0.01**	0.01
Contested Possessions	0.21***	0.03	0.21***	0.03
Uncontested Possessions	0.00	0.01		
Hitouts	-0.02	0.01		
Tackles	0.09***	0.02	0.09***	0.02
Rebounds	2.48***	0.06	2.48***	0.06
Inside 50s'	2.63***	0.06	2.63***	0.06
Clearances	-0.06*	0.03	-0.06*	0.03
Clangers	-0.44***	0.03	-0.44***	0.03
Bounces	0.054**	0.03	0.06**	0.03
Marks Inside 50	0.18***	0.05	0.18***	0.05
Assists	2.81***	0.07	2.81***	0.07
Frees For	0.91	0.60		
Frees Against	1.26**	0.60	0.35***	0.05
One Percenters	0.13***	0.02	0.13***	0.02
Constant	-0.27	0.24	-0.27	0.24
Observations	2,918		2,918	
Adjusted R-squared	0.92		0.93	
F-Statistic	1,981.31		2,376.62	
Prob(F-Statistic)	0.00		0.00	

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

Table S4.2: Predicted discount rates per pick based on models (4.4-4.7)

Pick	Year 1	Year 2	Year 3	Year 4
1	47.49%	24.43%	11.78%	3.41%
2	47.99%	25.02%	12.32%	3.69%
3	48.45%	25.65%	12.79%	4.04%
4	48.83%	26.20%	13.17%	4.39%
5	49.15%	26.70%	13.49%	4.74%
6	49.38%	27.12%	13.73%	5.05%
7	49.52%	27.48%	13.92%	5.33%
8	49.60%	27.76%	14.06%	5.57%
9	49.62%	27.99%	14.17%	5.78%
10	49.61%	28.17%	14.27%	5.96%

11	49.59%	28.32%	14.38%	6.13%
12	49.57%	28.45%	14.49%	6.28%
13	49.56%	28.59%	14.63%	6.42%
14	49.57%	28.72%	14.78%	6.54%
15	49.61%	28.86%	14.93%	6.65%
16	49.66%	29.01%	15.09%	6.75%
17	49.73%	29.16%	15.23%	6.84%
18	49.82%	29.31%	15.35%	6.94%
19	49.91%	29.45%	15.46%	7.02%
20	50.03%	29.58%	15.55%	7.12%
21	50.13%	29.70%	15.62%	7.17%
22	50.23%	29.80%	15.64%	7.24%
23	50.31%	29.91%	15.65%	7.26%
24	50.39%	29.98%	15.62%	7.32%
25	50.46%	30.03%	15.61%	7.34%
26	50.51%	30.10%	15.57%	7.37%
27	50.55%	30.12%	15.51%	7.39%
28	50.57%	30.13%	15.44%	7.42%
29	50.58%	30.11%	15.43%	7.38%
30	50.59%	30.09%	15.37%	7.39%
31	50.59%	30.07%	15.35%	7.38%
32	50.58%	30.04%	15.37%	7.40%
33	50.56%	30.03%	15.40%	7.40%
34	50.53%	29.96%	15.43%	7.41%
35	50.51%	29.89%	15.51%	7.40%
36	50.50%	29.88%	15.51%	7.41%
37	50.49%	29.85%	15.54%	7.41%
38	50.50%	29.80%	15.54%	7.40%
39	50.48%	29.73%	15.54%	7.37%
40	50.46%	29.69%	15.55%	7.34%
41	50.48%	29.65%	15.55%	7.31%
42	50.53%	29.63%	15.56%	7.29%
43	50.59%	29.62%	15.54%	7.27%
44	50.65%	29.59%	15.53%	7.25%
45	50.68%	29.54%	15.49%	7.23%
46	50.67%	29.47%	15.43%	7.20%
47	50.62%	29.37%	15.35%	7.17%
48	50.50%	29.23%	15.41%	7.15%
49	50.35%	29.08%	15.44%	7.14%
50	50.18%	28.92%	15.47%	7.11%
51	49.97%	28.74%	15.55%	7.10%
52	49.75%	28.55%	15.62%	7.09%
53	49.51%	28.36%	15.67%	7.08%
54	49.26%	28.15%	15.74%	7.07%

55	49.01%	27.95%	15.83%	7.06%
56	48.74%	27.73%	15.91%	7.05%
57	48.47%	27.51%	16.02%	7.04%
58	48.19%	27.29%	16.12%	7.03%
59	47.91%	27.07%	16.24%	7.02%
60	47.61%	26.85%	16.34%	7.02%
61	47.31%	26.63%	16.45%	7.01%
62	47.01%	26.40%	16.57%	7.01%
63	46.70%	26.18%	16.67%	7.00%
64	46.38%	25.95%	16.82%	7.00%
65	46.07%	25.72%	16.92%	-
66	45.73%	25.50%	17.05%	7.00%
67	45.38%	25.26%	17.17%	7.00%
68	45.00%	25.03%	-	-
-69	44.65%	24.80%	17.39%	7.01%
70	44.23%	24.55%	17.50%	7.02%
71	43.82%	24.32%	17.62%	7.03%
72	43.43%	24.08%	-	-
73	42.95%	23.80%	17.82%	7.04%

Table S4.3: AFL DVI with discounted rates for future picks

Pick	Current AFL DVI	Year 1	Year 2	Year 3	Year 4
1	3,000.00	1,575.40	1,190.57	1,050.36	1,014.56
2	2,517.00	1,309.05	981.48	860.60	828.87
3	2,234.00	1,151.72	856.36	746.84	716.70
4	2,034.00	1,040.76	768.07	666.89	637.58
5	1,878.00	954.88	699.95	605.50	576.77
6	1,751.00	886.36	645.96	557.24	529.08
7	1,644.00	829.85	601.83	518.06	490.47
8	1,551.00	781.77	564.71	485.30	458.28
9	1,469.00	740.13	532.99	457.47	431.03
10	1,395.00	702.98	504.96	432.88	407.06
11	1,329.00	670.01	480.27	411.21	386.00
12	1,268.00	639.50	457.53	391.22	366.66
13	1,212.00	611.33	436.56	372.69	348.75
14	1,161.00	585.47	417.30	355.61	332.35
15	1,112.00	560.38	398.64	339.10	316.54
16	1,067.00	537.14	381.32	323.80	301.93
17	1,025.00	515.26	365.01	309.43	288.26
18	985.00	494.31	349.44	295.79	275.26
19	948.00	474.81	334.98	283.18	263.30

20	912.00	455.75	320.95	271.06	251.77
21	878.00	437.86	307.82	259.74	241.11
22	845.00	420.59	295.25	249.08	231.05
23	815.00	404.96	283.84	239.40	222.01
24	785.00	389.44	272.70	230.11	213.27
25	756.00	374.55	262.07	221.16	204.93
26	729.00	360.82	252.22	212.96	197.27
27	703.00	347.66	242.95	205.27	190.10
28	677.00	334.65	233.83	197.73	183.05
29	653.00	322.68	225.52	190.72	176.64
30	629.00	310.82	217.31	183.91	170.32
31	606.00	299.45	209.41	177.26	164.18
32	584.00	288.60	201.92	170.88	158.24
33	563.00	278.36	194.78	164.78	152.59
34	542.00	268.11	187.79	158.81	147.05
35	522.00	258.33	181.12	153.03	141.70
36	502.00	248.51	174.27	147.23	136.32
37	483.00	239.16	167.76	141.70	131.20
38	465.00	230.19	161.61	136.50	126.40
39	446.00	220.87	155.20	131.08	121.42
40	429.00	212.55	149.45	126.21	116.95
41	412.00	204.04	143.55	121.23	112.37
42	395.00	195.41	137.51	116.12	107.66
43	378.00	186.76	131.45	111.01	102.94
44	362.00	178.65	125.78	106.25	98.54
45	347.00	171.14	120.58	101.91	94.54
46	331.00	163.29	115.17	97.40	90.39
47	316.00	156.05	110.22	93.30	86.61
48	302.00	149.48	105.79	89.48	83.08
49	287.00	142.48	101.05	85.45	79.35
50	273.00	136.00	96.67	81.71	75.90
51	259.00	129.58	92.34	77.99	72.45
52	246.00	123.60	88.31	74.52	69.24
53	233.00	117.63	84.27	71.07	66.04
54	220.00	111.62	80.20	67.57	62.80
55	207.00	105.54	76.04	64.01	59.49
56	194.00	99.44	71.86	60.43	56.17
57	182.00	93.79	67.99	57.09	53.07
58	170.00	88.08	64.04	53.72	49.94
59	158.00	82.31	60.03	50.28	46.75
60	146.00	76.49	55.95	46.81	43.53
61	135.00	71.13	52.19	43.61	40.55

62	123.00	65.17	47.97	40.02	37.21
63	112.00	59.69	44.07	36.72	34.15
64	101.00	54.15	40.10	33.36	31.02
65	90.00	48.54	36.05	29.95	29.95
66	80.00	43.42	32.35	26.83	24.96
67	69.00	37.69	28.16	23.33	21.70
68	59.00	32.45	24.33	24.33	24.33
69	49.00	27.12	20.40	16.85	15.67
70	39.00	21.75	16.41	13.54	12.59
71	29.00	16.29	12.33	10.16	9.44
72	19.00	10.75	8.16	8.16	8.16
73	9.00	5.13	3.91	3.21	2.99

Chapter 5: Valuing the Option to Extend a Draftee Contract

This chapter is presented in the accepted format of the publication cited below.

Chandrakumaran, J., Larkin, P., McIntosh, S. & Robertson, S. (2023). Optionality in Australian Football League draftee contracts. *PLoS ONE*, 18(9). DOI: 10.1371/journal.pone.0291439

PLOS ONE

RESEARCH ARTICLE

Optionality in Australian Football League draftee contracts

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Paul Larkin	15%	Assisted with conceiving the study, manuscript development and revision.	[redacted]	3/10/24
Sam McIntosh	15%	Assisted with conceiving the study, data analysis, validation and revision.		9/10/24
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Abstract

Though player drafts have commonly been utilised to equitably disperse amateur talent and avoid bidding wars, often they have also been accused of creating a monopsony labour market which restricts player movement. Within the Australian Football League (AFL) some have called for the increase of the initial draftee contract from two to three seasons, which further pushes the envelope on monopsony power. Instead of increasing the contract length, this paper suggests a call option to be purchased by the teams allowing them to add a further season to the draftee contract at a predetermined compensation package should they choose to do so at the end of the initial contract. The call prices per pick were calculated using the Black-Scholes model and were valued between 1% and 1.5% of the pick value. However, it failed to follow a monotonic function similar to pick value, owing to managerial overconfidence and sunk investment plays. Overall, the findings allow teams to procure the option of increasing initial draftee contracts and not impede further on a player's ability to move.

Keywords

Draft pick value; survival analysis; Black-Scholes; option price; football; player draft; high performance

5.1 Introduction

Pay and performance in the labour market has attracted the interest of many both in the solicitation of service and the employment/retention of talent. However, with most jobs requiring skills that ought to be developed, the cost of training has equally been brought into the debate. Though employers might like such costs to be borne by the apprentices exclusively, studies have suggested that the opposite materializes for a variety of reasons. Despite this, during the training period, employers do incur a net cost, as the wages paid to an apprentice would be higher than their marginal product, until a surplus is gained post proficiency (refer to Figure 1 in Gambin et al. (2010)). Hence, to guarantee recouping the investment in training, employers might resort to stricter terms, including but not limited to pre-employment contracts to extend post proficiency retention (Dockery et al., 1997; von Bergen & Mawer, 2007).

However, within the professional services market, where employees have specific skills (Becker, 1994), employers unavoidably have to invest in training, as the failure to do so will result in unfavourable cost-benefit ratios (or the absence of a benefit (Walter et al., 2006)). As the personal services provided by such individuals are essentially unique to them, the market value for such talent could increase exponentially. Furthermore, given that labour market frictions such as wage compressions are more likely to happen with such employees, firms are endeavoured to invest in their upliftment (Acemoglu & Pischke, 1999). Yet, how can an employer recoup their investment when they incubate such talent with an aim to elicit performance without impeding on the earnings potential of the employee? We aim to propose an alternative solution using the Australian Football League (AFL) player draft, where the proper investment in talent by teams could lead to strategic outcomes both on and off the field of play.

5.2 The Case of the AFL Draft

In 1936, the National Football League (NFL) created the first player draft with the intent of creating an equitable mechanism for the allocation of amateur talent and avoid a bidding war for the athletes (Maxcy, 2012). Teams take turns to select players in the reverse order of their regular season standing immediately prior to the draft, with the club finishing last receiving the first pick. After all teams make their respective selections (i.e., one round), the process is repeated again. The allocation of picks under this method is expected to cyclically alter the fortunes of each team within the league and increase the overall competitiveness of the sport (Tuck & Richards, 2019). Wanting to achieve the same, many sporting leagues across the world have incorporated versions of the player draft as competitive balance measures, including the AFL, who introduced this concept in 1986.

Irrespective of its benefits to the competition, the draft has been accused of inadvertently creating a monopsony market for amateur talent (Dabscheck, 2004). Amateurs signed on by clubs through the draft in most sporting leagues are usually restricted from moving to different teams within their initial contract period, which reduces their earnings potential in comparison to their veteran (or unrestricted) peers (Daymont, 1975; Humphreys &

Pyun, 2017; Krautmann et al., 2009; Massey & Thaler, 2013; Scott et al., 1985; Scully, 1974). Clubs within Major League Baseball (MLB) use this provision to underpay these players, though teams have often cited training costs which indirectly increases their overall outgoings (Krautmann et al., 2000). This has sparked multiple labour actions in the past including a successful legal challenge (*Adamson v New South Wales Rugby League Ltd (1991) 31 FCR 535, 268)* in the Australian National Rugby League (NRL, the premier rugby league in Australia, with the second highest domestic sport viewership next to the AFL), where the court ruled the draft, [1] limited the freedom of a player to select their employer (Ibid, 280), and [2] imposed a new post-contractual restraint upon them (Ibid, 281). This begs the question on how the draft and subsequent player contracts could be augmented to suit the competing interests of the players, teams, and the league overall.

Unlike most of its North American professional league counterparts, where initial draftee contracts are between three to four years, AFL teams provide a two-year contract for new draftees entering the league. However, with an increasing consensus that the initial two seasons does not allow teams to fully recoup their investments and retain amateur talent, clubs have lobbied for the contract length to be increased by one year (Twomey & Cleary, 2021), especially for players selected in the first round of the draft. The driving force behind this suggestion has been the earnings exponential secured by draftees from their third season, after the expiry of their initial contracts. Though the AFL draft has never been legally challenged, the proposed change would violate both clauses cited within the NRL precedent. Hence through this paper, we aim to introduce a model to value a team's right to retain a draftee for the third season using financial option theory (similar to the NFL's fifth year contract extension for draftees selected in the first round (NFL, 2020)). Essentially at the time of the draft, if a club wishes to retain a player for three seasons instead of two, they will purchase this right from the player using a call option, which they could exercise at the end of the initial draftee contract. This would then protect a team from engaging in a bidding war for the services of the player at the end of the two seasons and guarantee the player a fair compensation package for the third season. Hence the overarching aim of this paper is to, [1] identify the best alternative pick value method in the existing literature; [2] understand if it is in the best economic interest of a player to move to another club at any time during their career, which would warrant the need for higher compensation to retain the same; and [3] value the call option price for each pick allowing teams to extend the initial draftee contract from two to three seasons.

5.3 Pick Value

Draft picks assigned to teams by the league each year are essentially financial instruments owned by the benefitting clubs. Teams can opt to either use the pick to select an amateur player or trade it for a player, another pick(s), or a selection(s) in the future. Given these picks are indivisible themselves and have varying levels of value associated to them, a litany of academic work has been presented in the past to value them. The first known draft pick value chart (PVC) was created by Mike McCoy and Jim Johnson of the Dallas Cowboys (an NFL club) in the late 1980s' using a Weibull distribution model to equate draft day trades (i.e., where the earliest pick in each trade was equal to net of all other picks in the exchange). The proposed chart declined at an exponential rate where the difference between the first two picks was approximately 1/6th of the first pick. However, as trades themselves include the biases of perceived value inferred upon them by decision makers (including overconfidence, confirmation bias etc.), the validity of the PVC has been questioned in the past (Massey & Thaler, 2013).

Hence, Dawson and Magee (2001) suggested that a pick value function ought to be both inverse and monotonic (a function that either never increases when inverse or decrease when direct), using an isotonic regression to predict the expected games played of draftees in the National Hockey League (NHL) based on the initial pick number used to select them. Their findings, while upholding their hypothesis, showed a lower rate of decline in pick value when compared to the PVC. Conlin and Emerson (2005) expanded on this to use games started and active contract lengths as determinants of pick value in the NFL reconfirming the previous findings, similar to Schuckers who plotted this relationship with the help of local polynomial functions both in the NFL (Schuckers, 2011a) and NHL (Schuckers, 2011b). Studies within the AFL have also used player ratings to determine pick value through linear regression models (Mitchell et al., 2011; Stewart et al., 2016) as the league's own draft value index (DVI) mimicked certain properties in the NFL PVC. The common trend reciprocated by all of the aforementioned publications suggested that the indices used by the leagues over valued initial picks and that an ideal value function would decrease at a much lower rate.

5.3.1 Data

For the purposes of this study, we used the survival estimate model proposed by Chandrakumaran (2022) and Glasson and Bedford (2009) as it enables the continuous evaluation of picks at different times in their careers. Survival models are commonly used in the pharmaceutical industry to evaluate the life expectancy of those involved in clinical trials. Similarly, we use this framework to determine the probability of a player to survive or continue in the league based on the pick used to select them. To replicate the methodology, the career metrics of all draftees selected between 2003 and 2016 and their retrospective performance from 2004 to 2017 was collected from Sorenson Technologies (a third-party data agency that provides data for the gambling industry sourced from the league). Although the draft has been in place since 1986, a decision was made to use post 2003 data owing to a variety of factors including, the completeness and accuracy of the data and the effectiveness of the draft itself. Prior to 2003, less than 80% of drafted players actually played at least one game in the league, and the number of recruits per season varied considerably. Moreover, with a majority of players selected after 2016 still playing in the league and the disruptions caused due to the pandemic, the subsection of newer recruits warranted to be excluded. Of the 1,123 draftees within this timeframe, players who previously played within the AFL (players who were delisted and have not secured a contract to play before the draft, are allowed to enter the draft in the AFL) and rookie elevations (teams use later picks to elevate players in their rookie lists to the senior squad, which might not reflect their actual worth), were removed from the sample to mitigate any biases, leaving a pool of 905 recruits. Based on the listing statics of players within this sample in Table 5.1, there is a clear drop in listed draftees from the third season. This could be due to decision makers delisting players who do not meet certain performance criterion after their initial contract phase. Moreover, the average pick (or selection) number drops each year as well, as teams only retain players who were selected early on in the draft, where the expected performance might be relatively high. It is also important to note that 48% of the sample was actively playing in the league as of 2018.

Table 5 1: Career listing outcomes of draftees and their respective performance since being drafted

Years Since First Drafted	No. of Draftees Eligible to Play	No. of Draftees Listed in the year	No. of Draftees who Played in the year	Averages per year of listed draftees		
				Age	Pick	Games Played
1	905	905	531	19.17	33.69	4.91
2	833	828	610	20.14	33.3	7.73
3	766	686	575	21.12	31.48	9.84
4	697	570	504	22.09	30.03	11.77
5	638	447	408	23.05	28.34	12.59
6	578	371	335	24.03	28.06	13.18
7	513	289	267	24.99	26.83	13.74
8	445	226	213	25.94	26.09	14.06
9	382	172	160	26.92	25.08	14.65
10	312	126	121	27.92	25.32	14.53
11	249	87	80	28.85	26.38	13.97
12	179	45	39	29.62	21.69	13.16
13	118	23	21	30.57	21.91	12.39
14	57	6	6	31.33	33.67	10.83

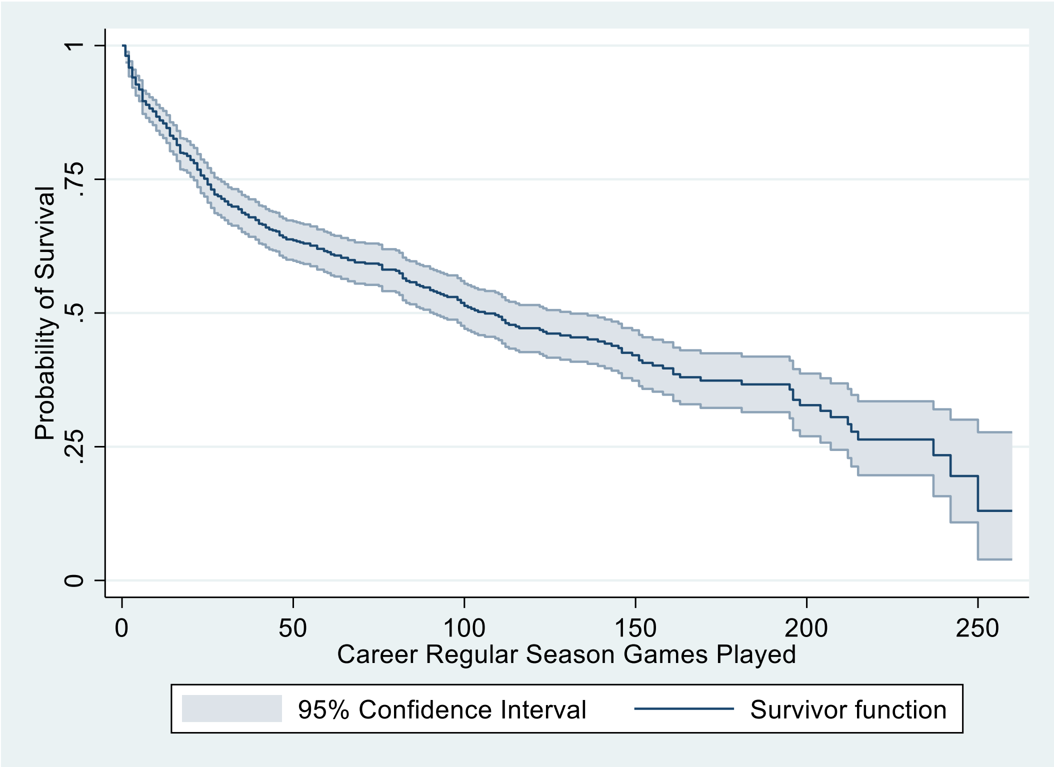
5.3.2 Design & Results

The survival function, *S(t)*, for a player's career having a length *T* of more than *t* games is given in Equation 5.1, where *F(t)* is the cumulative density function for that player. This timeframe is assumed to be the time in which a draftee is listed to play a game until they eventually retire or are delisted. The hazard event is excluded (or considered still active) if a player is delisted in one season and picked up by another team in a few years.

$$S(t) = P(T > t) = \int_t^\infty f(u)du = 1 - F(t) \tag{5.1}$$

The Kaplan-Meier survival estimate function of all draftees within the sample is given in Figure 5.1. This shows the probability of a draftee surviving in the league, should they play *t* regular season games. Based on the curve we can expect a draftee to play a median of just over 100 games in their career (at y=0.5 refer to the value of x).

Figure 5.1: Kaplan-Meier survival estimate of draftees selected between 2003 and 2016



Whilst this allows the prediction of a draftee's expectancy to survive based on the games they have played; a Cox proportional hazards model was employed to value each individual selection. Though a classical model always uses hazard rates we retrospectively augmented this to evaluate survival instead of hazard to keep in line with the theme, through Equation 5.2. Here $S_i(0)$ refers to player *i*'s probability to survive in the league, based on the estimated coefficient (β_1) for the pick used to select them $(Pick_i)$. Also, $S(0)$ refers to the survival estimate of a draftee after playing zero games as observed in the Kaplan-Meier survival function given in Figure 5.1.

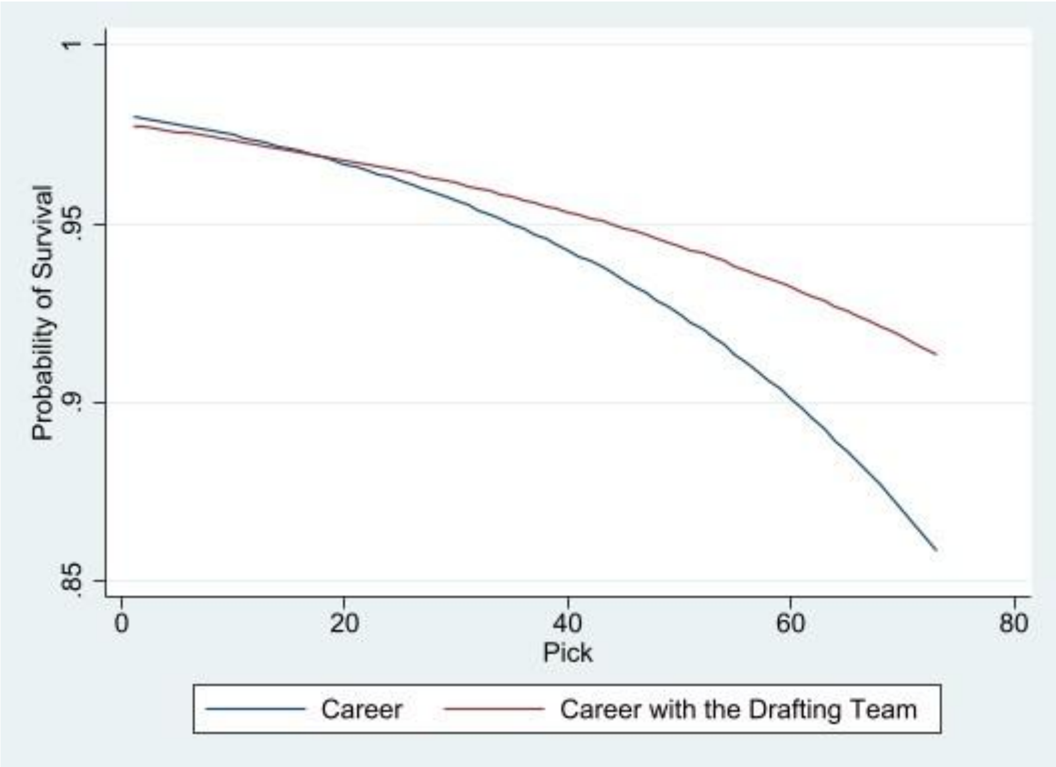
$$S_i(0) = 1 - \left(\left(1 - S(0)\right) * \exp(\beta_1 Pick_i)\right) \quad (5.2)$$

After setting the cross sectional data set as a survival panel, $S(0)$ was estimated at 0.9808 with β_1 retaining a value of 0.0274 (refer to the estimation results in Table S5.1 model 5.1). The calculated survival estimate per pick is given in Table S5.2 within the supporting information (column: Spot Price). This also mimicked the value function estimated in the previous studies (Chandrakumaran, 2022; Glasson & Bedford, 2009). As a robustness check the Cox-Snell residuals were mapped in Figure S5.1, showing a Nelson-Aalen cumulative hazard following the prior closely at 45^0 except at very large volumes. With a mean of 104 and a tail spanning across till 260, this variation in the larger volumes is deemed acceptable for the purposes of this study. Overall, the pick value function derived through this exercise upheld the inverse monotonic assumption laid out in the existing literature and will be used as the baseline model for the forthcoming sections.

5.4 Transferring Teams

Prior to creating an option pricing model to incorporate the option to extend a contract to a third season, it is essential to understand if the option to explore moving teams is in the best economic interest of a player. On the other hand, players might also entertain the prospect of moving, to get the exposure of playing with a championship team, be listed in a lower rated team to get more consistent game time and even relocate closer to their families. Previous research within the AFL has suggested players who remain with the team that initially drafted them tend to provide 27 points per season to the team's net point difference (Chandrakumaran, 2021). Yet, to verify this against each individual selection, the survival estimate model (Equation 5.2) used in the previous section was repeated utilizing the career regular season games of a recruit with the team that drafted them as per model 5.2 in Table S5.1 and graphically denoted in Figure 5.2 together with the initial survival estimates for the whole career from the previous section (the robustness check which yielded a similar outcome is presented in Figure S5.2).

Figure 5.2: Survival estimates per draft selection at t=0 in both their drafting team career and their entire career



Overall, based on the curvature of the graphs, most players did perform better with the team that initially drafted them as demonstrated by the higher survival estimates. However, those who were drafted early on using picks one through to sixteen, which is the same group targeted by the proposed change, did have a slight advantage had they moved to a different team at any point in their career. Based on the collective bargaining agreement (CBA) for the period ending 2022 (AFL, 2017), this would also bring in increased economic returns for the player as well, as more games yielded more variable pay (however it is important to note that athletic pay in the sport industry is determined by considering various variables that may not predominantly relate to marginal productivity (Blass, 1992)). On the other hand, post pick sixteen, moving clubs proved to be detrimental for the player. This could be attributed to a variety of factors including, clubs providing lengthier lucrative contracts for early picks to leave their drafting clubs, managers or coaches giving early selections more game time to justify their investments, and teams having to drop players giving due consideration to roster and salary cap limits, whilst facilitating incoming transfers. The findings here highlight the need for players to be fairly compensated by teams in their contracts and eventual negotiations, especially if there are any restrictions on player movement.

5.5 Option Value

One suggestion that has been presented is to allow teams to retain a player they recruit through the draft for one more season after the end of the initial contract at season two. The proposal would eventuate between the team and the player at the time of the draft (*t=0*). Hence, the best way to cater to this premature contract is through an option.

5.5.1 Empirical Framework

In theory, a call option would be purchased by the team selecting the player, agreeing to a pay them a predetermined salary for their third season at *t=0*. This would inherently [1] protect the team from exponential pay increases observed amongst draftees at the end of season two (*t=2*); whilst [2] allowing them to negate extending to a third season if they chose not to proceed with the player after their initial contract; and [3] give players the ability to negotiate a competitive compensation package for their third season subject to meeting a set of prerequisites. To explore this, the Black-Scholes model (BSM) was chosen (Black & Scholes, 1973) to value the call as it is quite commonly used with similar styled options (where the underlying asset will have a log normal distribution of prices following a random walk with a constant risk-free rate and volatility yielding no dividends during the life of the option), the formula for which is given in Equation 5.3.

$$C = S_t N(d_{1t}) - Ke^{-rt} N(d_{2t}) \qquad (5.3)$$

where

C = call option price

S_t = spot price

K = strike price

r = risk-free interest rate

t = time to maturity

σ_v = volatility

N = normal distribution

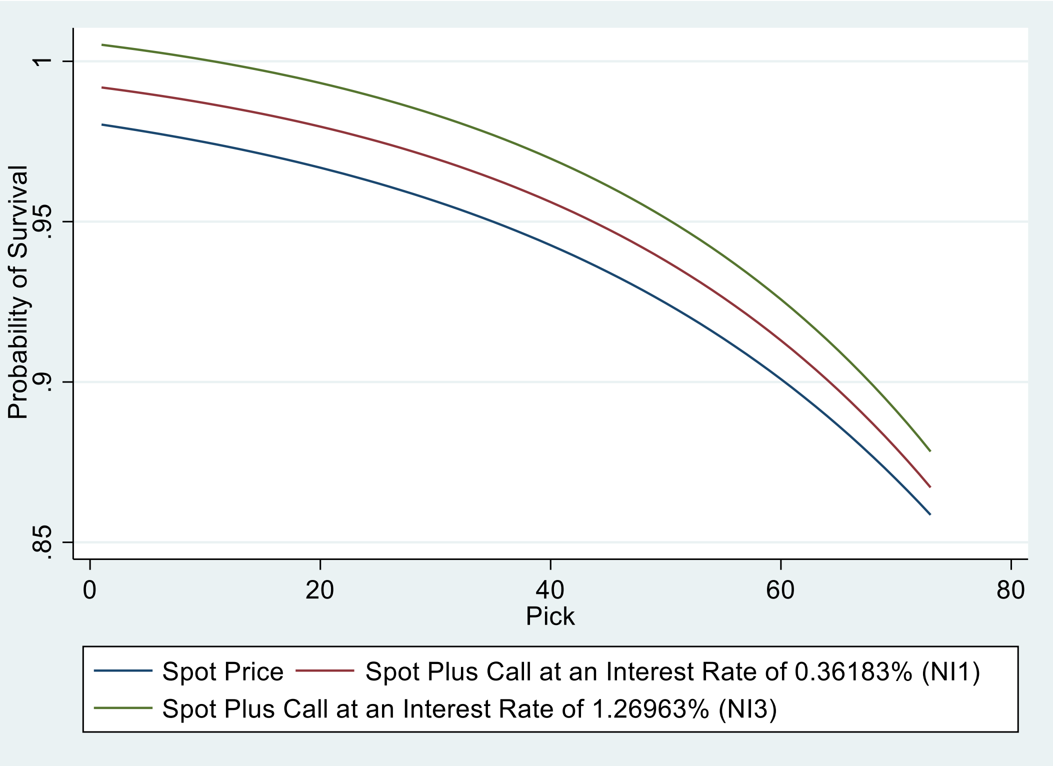
$$d_{1t} = \frac{\ln\frac{S_t}{K} + \left(r + \frac{\sigma_v^2}{2}\right)t}{\sigma_s\sqrt{t}} \tag{5.4}$$

$$d_{2t} = d_{1t} - \sigma_s\sqrt{t} \tag{5.5}$$

The BSM equation requires five key inputs. First of which is the spot price at $t=0$. As this has already been calculated in the previous pick value section (i.e., model 5.1 from Table S5.1), the same method was reused to define its strike price at $t=2$, which is the second input, utilizing the coefficients defined in Table S5.1 model 5.3 (the robustness check which yielded a similar outcome is presented in Figure S5.3). Thirdly, the volatility of each selection was computed using the pre-defined spot and strike prices before moving onto reaffirming the time to maturity as two, which is the current length of the draftee contracts. In terms of the risk-free interest rate, which is the last of the five inputs, the average improvement in regular season win percentage was used. As the data used in this study utilizes performance metrics from 2004 to 2017 for draftees from 2003 to 2016, the average net improvement (*NI*) per year from the 2006 season was calculated as it will be the third season of the first draftees from 2003 (as Gold Coast and Greater Western Sydney entered the league after 2006, their first two seasons were excluded from the sample).

The option prices based on the spot and strike were thus calculated and depicted in Figure 5.3 using two risk-free rates. The first being the average year-on-year increase in regular season winning percentage (*NI1*) and the second, the cumulative improvement over three seasons (*NI3*). [For example, if a team wins 5 out of 10 regular season games and subsequently wins 6 out of 10 games in the next season their net improvement would be 20%. This was estimated across all teams with the average set as *NI1* and the 3-year cumulative as *NI3*]. Since the option considered here looks at the benefit to a team in extending the draftee contract by one year, the year-on-year risk-free rate (*NI1*) suited the purpose of the study.

Figure 5.3: Career survival function (spot) & call option price



The analysis shows both the spot and call price functions run parallel to each other. The calls themselves were valued between 1% and 1.5% of the spot price. However, as shown in Table S5.2, individual call prices increase from the first pick through to forty-seven before declining again. Ideally as career earnings are usually higher amongst players recruited early in the draft (AFL, 2015a), the call price should be higher to represent the greater changes in compensation and then decline monotonically.

5.5.2 Discussion

The question now remains as to why the option costs of these picks do not decline monotonically as the coinciding pick values. Research in psychology has suggested people are generally confident in their decisions (Alpert & Raiffa, 1982). This is especially exacerbated when they have access to more information, similar to talent assessors who evaluate amateurs using a variety of metrics, including scout reports, game performance, player interviews and draft combine performance (Gogos et al., 2020). Secondly, within financial theory Kahneman and Tversky (1979) observed a phenomenon where people invest further resources to support a prior course of action when alternative options were available. Staw and Hoang (1995) repurposed this in the National Basketball Association (NBA) stating that general managers tend to play draftees picked early on in the draft even when their on-court performance did not warrant the decision and coined it as sunk investment plays.

With these two human irrationalities driving the decision makers in the team, players drafted early on are likely to get more game time in the third season irrespective of their outcomes. This will reduce the deviation in game time observed amongst such players, which is one of the inputs of the BSM. On the other hand, players drafted in the middle would not be similarly privileged as teams would delist them (or play them less frequently) because there is a high variability in their output when compared to their initial selection and their initial financial commitment does not warrant riding the loss. Hence the higher volatility pushes the price of the call up (Bollinger & Hotchkiss, 2003; Laezer, 1998).

Still, this experiment introduced an alternative solution by which teams could extend draftee contracts without adding any additional contractual constraints on the player. To put this into practice, let's assume that there is a team that wishes to purchase an option to extend the draftee contract of a player selected at pick one. If we assume that the player will be paid 0.9803 (refer to Table S5.1) in their entire lifetime, and 0.9753 of that would be paid from their third season, the team will have to pay 0.0116 (or 1.18%) of their expected total career earnings early on to purchase this option. At the end of the second season, the team can decide to exercise this option and force the player to play under the previously agreed terms or release them. Either way, the player has not been undercut of their potential and the team mitigates any upsides as well.

5.6 Conclusion

In the professional sport market, teams are continuously faced with the issue of restocking their rosters. As veteran players enter the free agency market to increase their net worth, teams themselves dip into the same market, whilst also investing in long term amateur athlete development plans. Given the AFL holds the draft to disperse this non-professional talent equitably, clubs are permitted to restrict the players they draft for two seasons. However, with increasing calls for the option of extending this period from two to three years, it is imperative this is done in a way that does not financially disadvantage the players.

In a perfect world, amateur players usually perform better overall when they continue to play for the team that initially drafted them (Stewart et al., 2016) . Yet, the key findings within this paper, while agreeing with this presupposition overall, suggested players selected through the first sixteen picks do tend to play more games (as represented by the slightly higher survival estimates) if they moved teams at any point in their careers. This would in turn increase the variable economic returns for the player. Hence it is plausible to assume that giving teams the ability to extend the initial contract period, even for one additional year, does indeed impose a ‘restraint of trade’ on the player.

In order to circumvent this, the optimal solution would be to give the teams the option to extend to the third season by purchasing this right at the time of the initial contract. Using the BSM, call option prices for each pick and their value as a percentage of the spot price were given in Table S5.2. This novel approach provides [1] players an additional inflow on top of the value of their pick (which is the price of the call); [2] teams the opportunity to negotiate third season wages today ($t=0$) rather than at the end of season two ($t=2$); and [3] clubs the option to withdraw from extending to third season if the draftee did not perform. Moreover, keeping these contracts and option to extend to relatively lower number of periods will discourage contract fatigue, and ensure draftees continuously deliver outcomes to match expectations (Krautmann & Oppenheimer, 2002). On the other hand, allowing teams to take options on future services would guarantee higher compensation for the players in the long run, than when they initiate the options themselves (Clayton & Yermack, 2001).

Whilst previously out of reach, the growing incorporation of technical staff within sporting teams would allow for the simultaneous refreshing of this method and retrofit it to other time frames. These could be three-year contracts with an option to extend for another one or more years and also repurposed to any league as long as the expected outcomes increases every season. If the expected outcome in the next season is less than the previous one, teams are better off paying the effective rate for the player as there would be no need to hedge against pay increases. Similarly, before such extension options are proposed, it is important to evaluate if a player's prospects in terms of playing time increases should they move to a different team. If not, a player would be better off playing for their drafting team as their prospects remain high. On the other hand, drafting teams could exert a higher level of monopsonic exploitation as the marketability of their skill is low elsewhere.

Likewise, in the general labour market, firms requiring workers with specific skills would ideally invest in the required training and upliftment of apprentices. This would translate to a period where these firms will incur a net cost as the productivity of these apprentices, will not match their wages. However, upon achieving said proficiency, the firm will make a profit through the surplus (difference between apprentice wages and marginal productivity). Still, should the apprentice depart the firm upon completing the training (to join a rival firm), the firm will break even on their total investment, or even make a net loss (refer to Figure 1 in Gambin et al. (2010)). This will lead the firm to be in a constant state of training without sustaining a proficient cohort in its workforce (Mohrenweiser & Zwick, 2009). Through this paper, we have suggested a way by which organisations could recoup on the surplus, using post traineeship workers for a smaller period of time, maintaining a balance between skilled workers and apprentices.

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Supporting Information

Figure S5.1: Fitted Residuals of the Career Games (t=0) Estimation

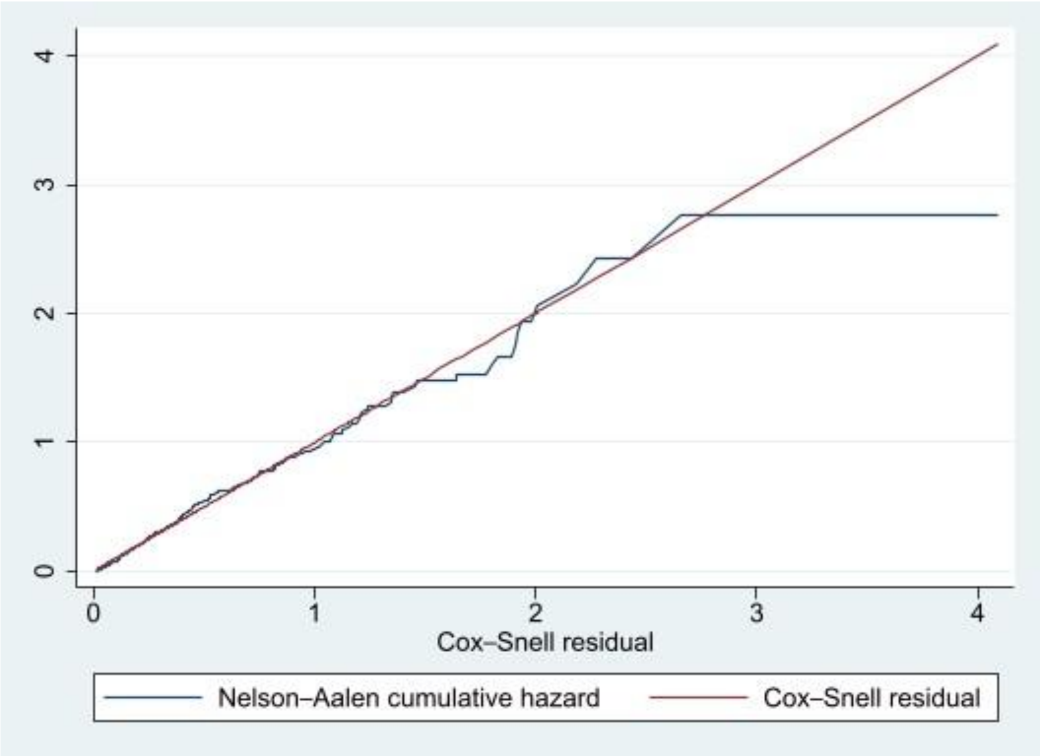

Figure S5.2: Fitted Residuals of the Drafting Team Games (t=0) Estimation

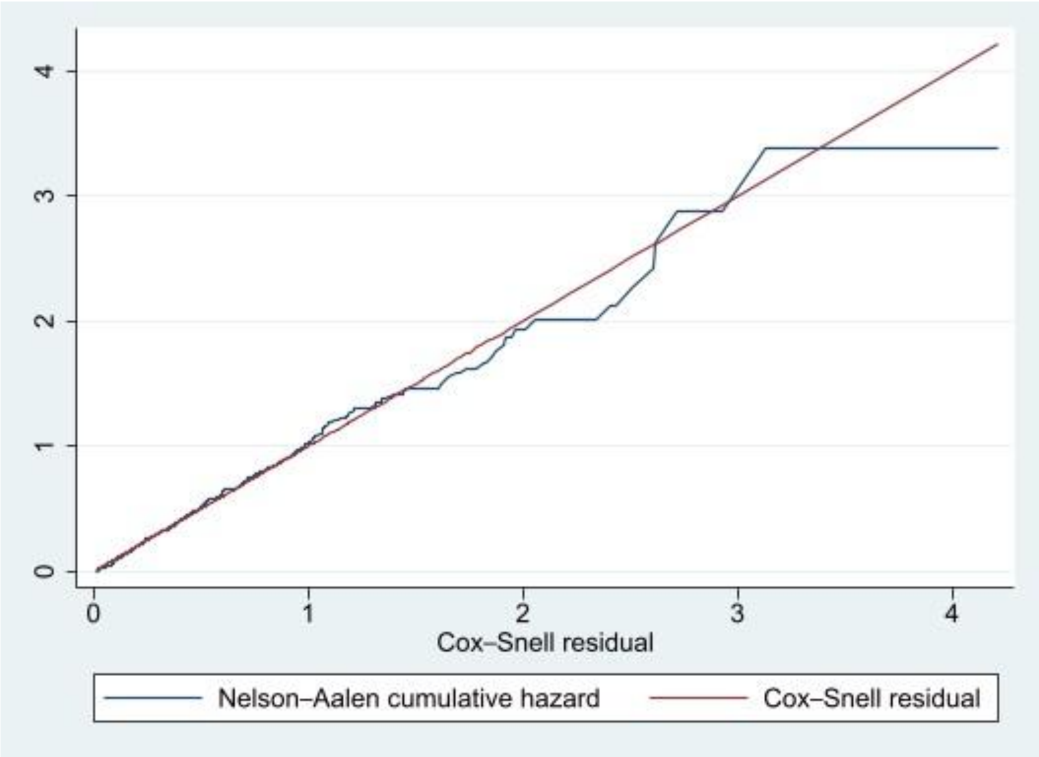

Figure S5.3: Fitted Residuals of the Career Games (t=2) Estimation

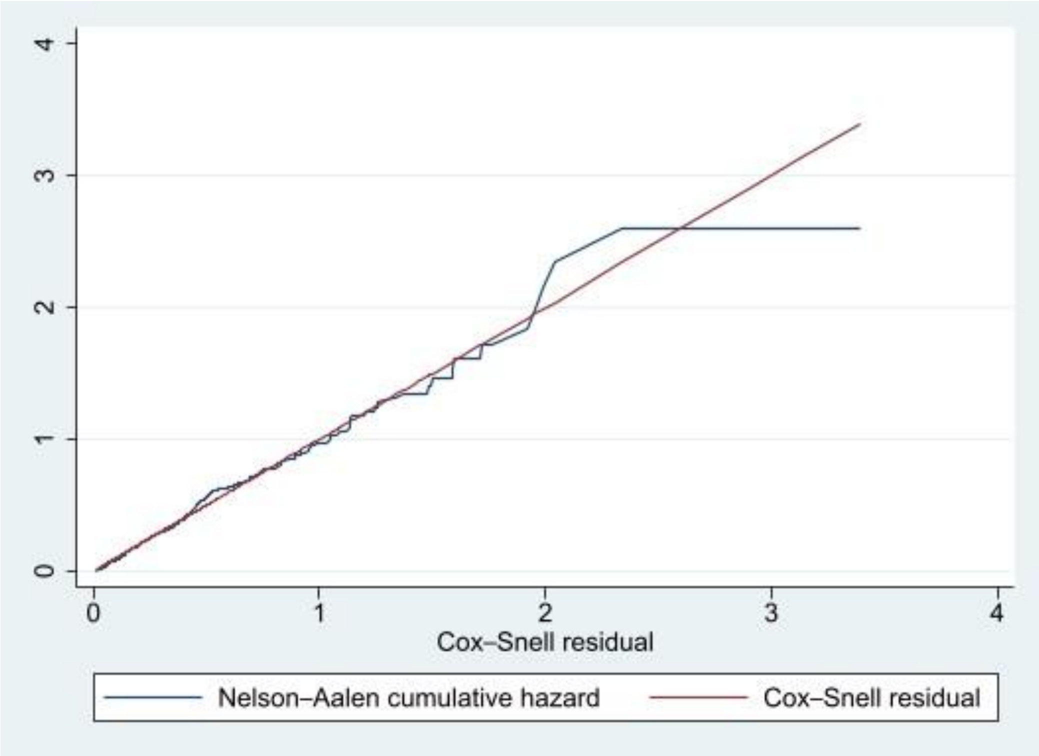

Table S5.1: Career Survival Models and Estimated S(0) and β1 values

S(0)	Scenario	Model	Hazard Ratio for Pick (β_1)	Std. Err.	P |z|	No. of Obs.
0.9808	Career Games	5.1	1.0274	0.0028	0.0000	782
0.9779	Career Games with Drafting Team	5.2	1.0187	0.0024	0.0000	770
0.9759	Career Games after Season 2	5.3	1.0245	0.0031	0.0000	622

Table S5.2: Spot and Option Prices

Pick	Spot Price	Strike Price	Call - Put Option Price to Extend with a Risk-Free Rate of		% of Spot Price	
			0.36183% (NI1)	1.26963% (NI3)	NI1	NI3
1	0.9803	0.9753	0.0116	0.0249	1.1810%	2.5389%
2	0.9797	0.9747	0.0116	0.0250	1.1888%	2.5494%
3	0.9792	0.9741	0.0117	0.0251	1.1966%	2.5599%
4	0.9786	0.9734	0.0118	0.0252	1.2045%	2.5704%
5	0.9780	0.9728	0.0119	0.0252	1.2123%	2.5808%
6	0.9774	0.9721	0.0119	0.0253	1.2201%	2.5913%
7	0.9767	0.9714	0.0120	0.0254	1.2279%	2.6017%
8	0.9761	0.9707	0.0121	0.0255	1.2357%	2.6120%
9	0.9754	0.9699	0.0121	0.0256	1.2434%	2.6224%
10	0.9748	0.9692	0.0122	0.0257	1.2512%	2.6326%
11	0.9741	0.9684	0.0123	0.0257	1.2589%	2.6429%
12	0.9733	0.9677	0.0123	0.0258	1.2665%	2.6530%
13	0.9726	0.9669	0.0124	0.0259	1.2742%	2.6631%
14	0.9718	0.9660	0.0125	0.0260	1.2817%	2.6731%
15	0.9711	0.9652	0.0125	0.0261	1.2892%	2.6831%
16	0.9703	0.9643	0.0126	0.0261	1.2967%	2.6929%
17	0.9694	0.9634	0.0126	0.0262	1.3040%	2.7026%
18	0.9686	0.9625	0.0127	0.0263	1.3113%	2.7122%
19	0.9677	0.9616	0.0128	0.0263	1.3185%	2.7217%
20	0.9668	0.9606	0.0128	0.0264	1.3256%	2.7310%
21	0.9659	0.9597	0.0129	0.0265	1.3326%	2.7402%
22	0.9650	0.9587	0.0129	0.0265	1.3395%	2.7492%
23	0.9640	0.9576	0.0130	0.0266	1.3462%	2.7581%
24	0.9630	0.9566	0.0130	0.0266	1.3528%	2.7668%
25	0.9620	0.9555	0.0131	0.0267	1.3592%	2.7753%
26	0.9609	0.9544	0.0131	0.0267	1.3655%	2.7835%
27	0.9598	0.9533	0.0132	0.0268	1.3716%	2.7915%
28	0.9587	0.9521	0.0132	0.0268	1.3776%	2.7993%
29	0.9576	0.9509	0.0132	0.0269	1.3833%	2.8069%
30	0.9564	0.9497	0.0133	0.0269	1.3888%	2.8141%

31	0.9552	0.9485	0.0133	0.0269	1.3941%	2.8210%
32	0.9539	0.9472	0.0133	0.0270	1.3991%	2.8277%
33	0.9526	0.9459	0.0134	0.0270	1.4039%	2.8340%
34	0.9513	0.9445	0.0134	0.0270	1.4083%	2.8399%
35	0.9500	0.9431	0.0134	0.0270	1.4125%	2.8455%
36	0.9486	0.9417	0.0134	0.0270	1.4164%	2.8506%
37	0.9472	0.9403	0.0134	0.0270	1.4199%	2.8553%
38	0.9457	0.9388	0.0135	0.0270	1.4230%	2.8596%
39	0.9442	0.9373	0.0135	0.0270	1.4258%	2.8634%
40	0.9427	0.9357	0.0135	0.0270	1.4282%	2.8666%
41	0.9411	0.9341	0.0135	0.0270	1.4301%	2.8693%
42	0.9394	0.9325	0.0134	0.0270	1.4316%	2.8715%
43	0.9377	0.9308	0.0134	0.0269	1.4325%	2.8730%
44	0.9360	0.9291	0.0134	0.0269	1.4330%	2.8739%
45	0.9342	0.9273	0.0134	0.0269	1.4329%	2.8741%
46	0.9324	0.9255	0.0134	0.0268	1.4323%	2.8736%
47	0.9305	0.9237	0.0133	0.0267	1.4310%	2.8723%
48	0.9286	0.9218	0.0133	0.0267	1.4290%	2.8702%
49	0.9266	0.9199	0.0132	0.0266	1.4264%	2.8672%
50	0.9246	0.9179	0.0132	0.0265	1.4231%	2.8633%
51	0.9225	0.9158	0.0131	0.0264	1.4190%	2.8584%
52	0.9204	0.9137	0.0130	0.0263	1.4141%	2.8525%
53	0.9182	0.9116	0.0129	0.0261	1.4083%	2.8455%
54	0.9159	0.9094	0.0128	0.0260	1.4016%	2.8373%
55	0.9136	0.9072	0.0127	0.0258	1.3939%	2.8279%
56	0.9112	0.9049	0.0126	0.0257	1.3852%	2.8171%
57	0.9087	0.9025	0.0125	0.0255	1.3754%	2.8050%
58	0.9062	0.9001	0.0124	0.0253	1.3645%	2.7913%
59	0.9036	0.8976	0.0122	0.0251	1.3524%	2.7761%
60	0.9009	0.8950	0.0121	0.0249	1.3390%	2.7592%
61	0.8981	0.8924	0.0119	0.0246	1.3242%	2.7404%
62	0.8953	0.8898	0.0117	0.0243	1.3079%	2.7196%
63	0.8924	0.8870	0.0115	0.0241	1.2901%	2.6968%
64	0.8894	0.8842	0.0113	0.0238	1.2707%	2.6716%
65	0.8864	0.8814	0.0111	0.0234	1.2495%	2.6441%
66	0.8832	0.8784	0.0108	0.0231	1.2263%	2.6138%
67	0.8800	0.8754	0.0106	0.0227	1.2012%	2.5806%
68	0.8766	0.8723	0.0103	0.0223	1.1738%	2.5443%
69	0.8732	0.8691	0.0100	0.0219	1.1441%	2.5045%
70	0.8697	0.8659	0.0097	0.0214	1.1117%	2.4608%
71	0.8661	0.8625	0.0093	0.0209	1.0765%	2.4128%
72	0.8624	0.8591	0.0090	0.0204	1.0381%	2.3599%
73	0.8586	0.8556	0.0086	0.0198	0.9960%	2.3014%

Chapter 6: Pick Trading & Post-Draft Performance

This chapter is presented in the accepted format of the publication cited below.

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The AFL Pick Trading Market as a Coasian Utopia

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1. PUBLICATION DETAILS (to be completed by the candidate)

Title of Paper/Journal/Book: Chandrakumaran, J. (2021). The AFL Pick Trading Market as a Coasian Utopia. Journal of Sports Economics, 22(1), 75-84. DOI: 10.1177/1527002520948108

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2. CANDIDATE DECLARATION

I declare that the publication above meets the requirements to be included in the thesis as outlined in the HDR Policy and related Procedures – policy.vu.edu.au.

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In the case of the above publication, the following authors contributed to the work as follows:

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3. There are no other authors of the publication according to these criteria;

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Updated: September 2019

Abstract

Sporting leagues have various competitive balance measures including player drafts, where teams are awarded picks based on prior performance. Teams, however, have the option to either exercise this pick or trade it as they see fit. An analysis of this trading market in the NFL stated that players obtained through traded picks contributed more to their recruiters in comparison to their counterparts. This paper retested this within the AFL and disproved this fact, establishing the Coasian notion of the efficient allocation of resources, based on some differences between the list management systems between the two leagues.

Keywords

Coase theorem; pick trade; efficient allocation; player draft.

6.1 Introduction

In response to dwindling spectator interest and continued dominance by the major Victorian teams, the Australian Football League (AFL) introduced the national player draft in 1986. Similar to its North American counterparts, selection order within the draft follows a reverse order system, whereby teams that finish last in the regular season immediately prior to the draft, pick first followed by the second last. Upon the completion of such selections, the process is reciprocated three or four more times (known as rounds) in the current version of the draft. The allocation of picks under this method allowed the league to cyclically alter the fortunes of each team and enforce the uncertainty of outcomes hypothesis (similar to the fishing position model suggested by Tuck and Whitten (2013)), while discouraging expensive bidding wars for the amateur talent pool.

The picks that are thus assigned by the league are essentially instruments owned by the benefiting team. When a team is prompted to use the pick, they can either exercise it to obtain a rookie to strengthen its list or trade it for another player, a pick, a selection in the future[17] or a combination of the three. The manner in which teams ought to select players

[17] Since its inception in 1986, the AFL has allowed teams to trade draft picks for other players. This was extended to include draft picks in the same year in 2006 and selections up to one year into the future in 2015.

has been subject to much debate and review. Brams and Straffin (1979) who initially examined this suggested that in a scenario where two or more teams chose rookies in a revolving order, the sincere outcome (or the best player that a team can pick at a given selection) is always Pareto optimal with respect to pairwise comparison. Even though the authors here were referring to the notion of selecting rookies, the same principle of best outcome could be used to define the rationale behind trading picks. For example, team A that is holding pick 20 in the draft could be eyeing a prospective midfielder early on in the draft which it believes could be procured by another team before it has the option to exercise its right. On the other hand, keeping tabs on a ruckman, team B which holds pick 2 might be interested in trading down as it is aware that such a positional player is usually not selected early on in the draft and it is within its best interest[18] to relieve its position. Under such circumstances, team A could trade up[19] and procure pick 2 from team B by relieving its 20th selection together with some further spots of equivalent value.

In 1960, Ronald Coase suggested that in the presence of an externality the market will achieve the efficient allocation of resources as long as transaction costs remain low and property rights are well defined. Under this proposition, irrespective of team B exercising its right to obtain the ruckman at pick 2 or trades the same selection to team A, which in turn selects the midfielder, the yield of the draftee over time should be the same. Hersch and Pelkowski (2016) explored the National Football League (NFL) draft pick trade market and concluded that the expected efficiency in a Coasian world was not achieved, which violated Massey and Thaler's (2013) advise of trading down, due to the lower number of trades, high transaction costs, inability to find trading partners in a dynamic environment and increased scrutiny from external stakeholders (including the media and spectators). This paper, however, retested this hypothesis within the AFL draft pick trade market and inferred on the contrary. The reasons behind the different outcomes within this setting could be attributed to a few factors. Unlike the previous study, contribution to the margin of victory was used as the dependant variable, which was controlled for certain rule changes, the position played by the draftee, age, race etc., so that an accurate

[18] The collective bargaining agreement (CBA) mandates a minimum salary for draftees based on the round of selection. Pick 2, which is in the first round, will hence attract a higher salary compared to the 20th selection, which is in the second round.

[19] Moving up the draft is known as trading up, while moving down as team B has in this example is known as trading down.

impression of his performance could be ascertained. Furthermore, as the AFL has a comparatively smaller squad to the NFL and a smaller draft, the scarcity of picks is assumed to make the market efficient.

6.2 Data & Empirical Specification

For the purposes of this study, data on all draftees from 2003 and 2016 and their relative performance from 2004 to 2017 was obtained from Sorenson Technologies while draft trade information was compiled from www.draftguru.com.au. To remove any biases imposed on the results, rookie elevations[20] and players who have played before[21] in the AFL were excluded together with those who were selected after pick 73 to coincide with the AFL's draft value index (DVI).[22] This yielded 908 draftees and 4,781 listed seasons.

In an attempt to verify the theory both in the immediate contract years[23] and a draftee's lifetime, the career cross section and seasonal panel were broken into two for the total career and the initial contract period. Previously, various metrics including games played (Schuckers, 2011a), time on field (Schuckers, 2011b) and the years taken to achieve a set number of games (Glasson & Bedford, 2009) have been used to quantify the contribution of a draftee after his initial selection. However, in this study, a player's contribution to the team's margin of victory[24] was used to analyse post draft performance,[25] as most

[20] Teams within the AFL maintain two lists called the seniors (which is the regular roster) and the rookies. To elevate a player from the rookie list to the seniors, teams are expected to use a draft pick in the year prior to the season in which the rookie is expected to play. As these players have experience playing pro football in the minor leagues under the tutelage of the major teams, their post draft performance is always relatively higher.
[21] Unlike the North American drafts, the AFL draft is not restricted to first time draftees alone. Players who have played before in the league and have been delisted are also eligible to be re-drafted to a team.
[22] The DVI was introduced in 2015 by the league to allow teams that exercise the priority access rules compensate teams that are affected by their actions using an appropriate pricing mechanism. The index was created by regressing career compensation of draftees selected over 15 years against the pick used to select them. An indexed graph of the DVI is shown in Figure S6.1.
[23] The AFL CBA mandates that draftees should be contracted for two years with the drafting team and prohibited them from playing for another team during this time.
[24] The contribution to margin of victory variable used in this paper was obtained by regressing a set of on field metrics such as kick and marks which translated to points in an AFL game based on the works of Stewart et al. (2007), Sullivan et al. (2014) and Robertson, Back, et al. (2016). It is worthwhile noting that that AFL's official player rating system (Champion Data Player Ratings) was also developed using a contribution to margin of victory model similar to the one used here.
[25] The models were also calibrated using games played and time on field, which provided similar results.

game time variants usually tend to carry sunk investment plays (Staw & Hoang, 1995)[26] by team managers to justify their drafting decision. Models 6.1 and 6.2 used the seasonal margin of draftees in their total career and in the first two seasons alone, while 6.3 and 6.4 observed the same under career cross sections instead.

In terms of explanatory variables, the log of pick was used to coincide with a conventional production function (Tuck & Richards, 2019) instead of two iterations of the same (one as is and the other a quadratic) used by many to represent the diminishing decline in the value of a pick. This is further compensated using positional dummies to evaluate on field biases together with an indigenous indicator to account for any hints of racial discrimination. Five additional dummies were also added to account for the varying rule changes of the two priority access selection provisions in the draft.[27] The seasonal models also included seasonal age of the draftees together with a quadratic of the same to account for experience effects, while a dummy was added to model 6.1 to identify if the rookie played for the same team as he was drafted.[28] Team indicators were used in the initial

[26] A sunk investment play is a situation in which a manager pours more resources to justify a previous bad decision. In the world of sports, a list manager would provide a rookie more game time even if his performance is not up to standard, just so that the recruiter can justify his decision to both recruit the player and sign him up for a higher wage scheme.

[27] There are two priority access rules in the AFL draft, namely father-son (F/S) and club-academy (C/A). Teams that invoke this rule have the opportunity to elevate themselves when a competing bid is made another team to recruit a rookie eligible under this method. One could say that this itself is a trade-up, as a team is trading up to obtain a player by forgoing certain picks. The consideration that they ought to forgo to invoke this varied across years. Players drafted under the F/S rule were distributed under three groups.

≤2006: Team that chose F/S players in or prior to the 2006 draft were only meant to compensate the competing bid for the same pick with a third-round pick.

2007≤2014: F/S players chosen between 2007 & 2014 are those who were affected by the 2007 rule change whereby teams were meant to match a bid for the same player with a pick in the same round.

≥2015: The DVI was introduced in 2015, whereby teams choosing F/S players had to compensate competing bids with equivalent draft points from the DVI.

Players drafted under the C/A rule were distributed under two groups.

≤2014: C/A players chosen in or prior to the 2014 draft were meant to compensate a competing bid for the same player using a pick in the same round.

≥2015: The DVI introduced in 2015, enforced the same bidding procedure observed by F/S players.

[28] The same team as drafting team dummy could only be used in model (6.1), as models (6.2) and (6.4) are only for the first two years of a draftee's career, where it is mandatory for the rookie to be listed in the drafting team as per the CBA. Also, it cannot be used in model (6.3) as it uses career performance as a cross section which includes game time for both the drafting and traded team. Please note that the term traded used in this footnote refers to being traded in the career of a player from one team to another and not as it is referred to in the body of this paper.

iterations of the model, but were omitted in the final version presented here as they failed to secure any significance as previously described by Stewart et al. (2016).

The primary dummy variable for this study, Traded-Up with a value of 1 was used to identify the earliest pick in each trade in all draft pick trades between 2003 and 2016. For example, if there is a trade involving a draft pick, for other picks and players, the earliest selection in the exchange would have 1 against it. To hold the hypothesis of this paper, it is expected that this variable remains insignificant under all iterations.

6.3 Results

All the control variables used in the models concurred with existing literature. Indigenous players always exceeded expectations suggesting systemic discrimination within the league, while rookies who play for the same team that drafted them in a given season fared better when compared to their counterparts (Mitchell et al., 2011). [Current works have noticed a higher proportion of such players occupy forward positions which might justify their higher comparative higher performance]. If a draftee's performance is as expected, teams would ideally retain them on their rosters and hence it is plausible for this to be positive. Midfielders contributed the most to the team's margin of victory, as is the norm in Australian Rules. On the contrary, forwards and ruckman were adversely affected the same when compared to defenders.

As stated in footnote 27, the priority access selections themselves are another version of teams trading up to obtain a rookie. Unlike a normal trade where teams agree on the terms, clubs are mandated a consideration by the league when they enforce these selections. As per Stewart et al. (2016), father-son draftees selected prior to 2007 gave their recruiters an advantage as teams only had to forgo a third round pick to procure them which was not in par with their expected performance. This inefficiency, which as subsequently corrected by the league, coincidentally concurs with the findings of Hersch and Pelkowski (2016). However, it is worth to notice that in the first two years of a draftee's career (as shown in models 6.2 and 6.4), this same edge is not prevalent.

The club-academy draftees selected after 2014 yielded a positive coefficient in the career model 6.3. While unexpected, this could be justifiable by the fact that these players are trained and groomed from their young age within the player academies of their future employers and hence well accustomed to their tactics. However, their seasonal margin yielded no such observable advantage.

Table 6.1: Regression Results

Method	*Panel Least Squares with Random Effects*		*Cross Sectional Least Squares*	
VARIABLES	Seasonal Margin (6.1)	Seasonal Margin (6.2)	Career Margin (6.3)	Career Margin (6.4)
LN(Pick)	-40.87***	-44.14***	-397.70***	-78.56***
	(2.54)	(2.534)	(31.87)	(5.09)
Season Age	125.70***	134.90***		
	(6.07)	(22.67)		
Season Age^2	-2.42***	-2.70***		
	(0.13)	(0.54)		
Club-Academy				
≤2014	1.14	5.423	-222.90	38.52
	(27.11)	(23.89)	(328.90)	(52.49)
≥2015	-1.04	0.0719	-758.50***	-18.33
	(25.32)	(20.21)	(233.50)	(37.26)
Father-Son				
≤2006	36.57**	-0.48	583.50**	-19.39
	(17.21)	(17.71)	(226.20)	(36.09)
2007≤2014	27.67	22.74	100.10	55.31
	(17.19)	(16.47)	(218.60)	(34.88)
≥2015	20.09	23.20	-452.10	12.51
	(53.91)	(42.61)	(433.60)	(69.19)
Indigenous	21.10**	29.31***	353.40***	49.69**
	(9.75)	(9.86)	(126.70)	(20.22)
Same Team for the Season as the Drafting Team	27.03***			
	(4.81)			
Traded-Up	***-0.11***	***-2.18***	***-90.31***	***-7.76***
	(5.88)	***(5.60)***	***(71.15)***	***(11.35)***
Position#				
Forward	-21.79***	-10.68*	-160.20**	-18.02
	(5.94)	(5.740)	(73.03)	(11.65)
Midfielder	34.44***	20.64***	213.20***	38.94***
	(5.86)	(5.66)	(72.06)	(11.50)

Ruckman	-48.25***	-36.93***	-249.10*	-58.40***
	(10.21)	(10.17)	(129.10)	(20.60)
Constant	-1,364***	-1,399***	2,105***	378.20***
	(71.45)	(236.70)	(118.60)	(18.92)
Observations	4,781	1,735	908	908
Adjusted R^2	0.31	0.26	0.19	0.25
No. of player groups	907	907		
Max. no. of seasons	14	2	14	2

Standard errors in parentheses; #the reference position is defender
*** p<0.01, ** p<0.05, * p<0.1

Seasonal age in both (6.1) and (6.2) confirmed the effect of experience on amateur players throughout their careers, with both the linear and quadratic variables obtaining a positive and negative coefficient respectively. Moreover, by obtaining a negative value, the log of pick upheld the commonly held conception of an inverse monotonic relationship between pick and performance (Conlin & Emerson, 2005). However, as expected the traded-up variable yielded no statistically significant values under all iterations.

6.4 Conclusion

In the professional sport market, teams always intend to one-up their competition. One such occasion is when team A wishes to trade up, team B either charges unjustifiable premiums to surrender its pick or holds on to its selection and drafts an amateur it does not require (or should have been picked at a later point). Irrational on the league's point of view, but justifiable on an individual level, one could presume that the inability of these participants to agree on terms (or agree on an uneven exchange of considerations) causes the market to fail in its objective to achieve the efficient allocation of resources.

In a Coasian utopia, however, teams that exercise a pick to recruit a player do so at a point that yields the highest return. Hersch and Pelkowski (2016) contradicted this within the NFL, as their model did show that draftees selected through picks that were traded up performed better when compared to rookies recruited by teams that owned the selection in the first place. But how did the AFL pick trade market achieve this efficiency? The answer lies in two key areas, namely, scarcity (and close homogeneity) of the resource being traded (picks in this case) together with near perfect market information.

Unlike the NFL draft which boasts 230+ picks per season, the AFL averages around 75 selections, even though the prior only has a team roster that is 26% larger than the latter.[29] The major difference here is that the American league allows teams to manage a 90-man list in the off season allowing them to cut down to 53 just prior to the start of the season. This explains the great difference in terms of the number of draftees who actually play a game in the league as NFL,[30] as most recruits are delisted to cater the listing cap. Giving list managers the option to recruit and then delist, allows teams to exercise (or trade) their pick to obtain a rookie with expected returns that is not in par with the selection used (for an unequitable consideration) which is further exacerbated due to the competitive incentives explained at the start of this section.

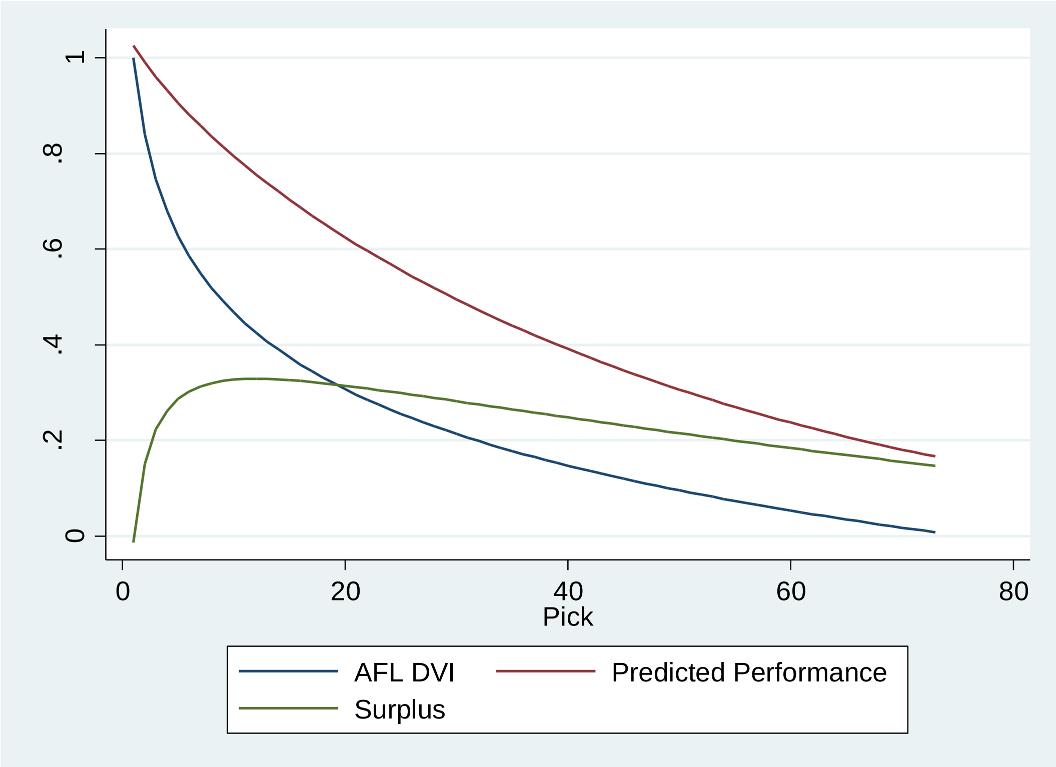
By forcing teams to maintain smaller rosters, the AFL inherently reduced the number of selections available in the draft, making each pick valuable and scarce. This in turn makes each market player to look for the most efficient outcome while reducing the effect of alternative motives on their choice. To obtain a comprehensive understanding prior to entering the draft, scouts and recruiters focus on observing the talent pool that is made available to be selected and also analyse the opposition to identify potential trading opportunities and salary cap manoeuvres, where 22% of the sample relates to trades (compared to 7% in the NFL).

Appendix

As a complementary exercise, the predicted performance from model 6.1 was fitted against each selection in the AFL national player draft and shown in Figure S6.1 together with the current AFL DVI. The difference between the two is depicted by the surplus line. As the AFL's DVI is based on compensation, a simple analysis of this graph suggests that it is in the team's best interest to trade down and in turn increase their surplus. Massey and Thaler's (2013) work on the NFL draft yielded a similar conclusion (refer to panel A, Figure 3). While the findings by Hersch and Pelkowski (2016) refutes this rationale, the resolution here at least holds the popular belief within the context of the AFL.

[29] An AFL team list is capped at 40 whereas the NFL limits it to 53.
[30] 46% in the NFL as per the sample used by Hersch and Pelkowski (2016) and 86% in the AFL based on the sample used for this study.

Figure S6.1: Pick value



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Chapter 7: Pick Trading & Career Tenure

This chapter is presented in the accepted format of the publication cited below.

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RESEARCH ARTICLE

Compounding endowment effects when trading draft picks in the Australian Football League

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Name(s) of Co-Author(s)	Contribution (%)	Nature of Contribution	Signature	Date
Paul Larkin	15%	Assisted with conceiving the study, manuscript development and revision.	[redacted]	3/10/24
Sam McIntosh	15%	Assisted with conceiving the study, data analysis, validation and revision.		9/10/24
Sam Robertson	10%	Assisted with conceiving the study, feedback and revision.		8/10/24

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Abstract

Endowment effect relates to a situation when decision makers are more likely to retain an object they own, than acquire the same object when they do not own it. Studies have often concluded that players recruited early on through drafts are more likely to be held in team rosters irrespective of their marginal utility. We tested the hypothesis wherein this effect would compound when the pick used to select a player is traded between teams. Using a sample of draftees selected between 2003 and 2016 in the Australian Football League, we created a proportional hazard model to predict the career longevity of a player with their drafting team and overall career. The results suggest each subsequent trade marginally reduced the exit of a player by a log normal rate of 0.269 in their career with the team that initially drafted them. The findings were attributed to the premium requested by the original team that is compounded with every exchange as the reference points used to determine value have also shifted with the trade.

Keywords

Prospect theory; endowment effect; escalation of commitment; player draft; decisional irrationality.

7.1 Introduction

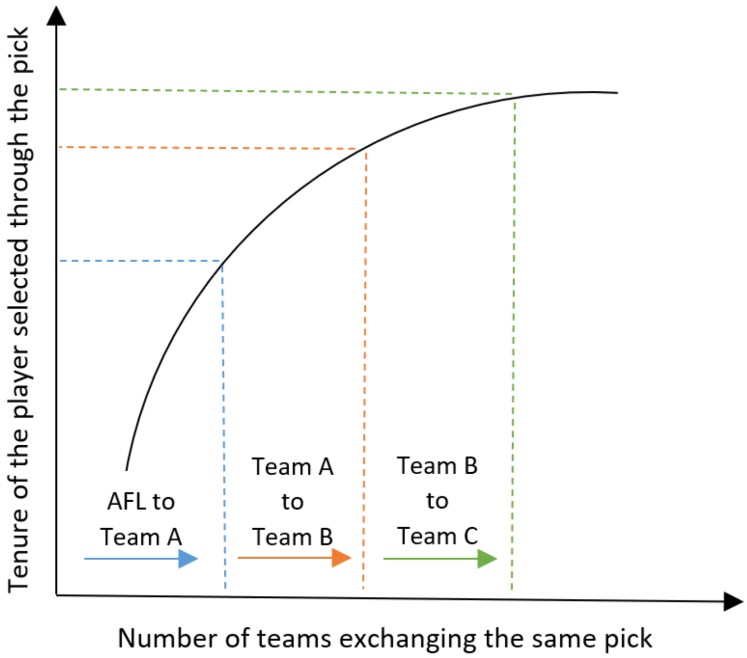
Player drafts are commonly used as a labour market intervention technique to equitably allocate amateur talent in sport. Most leagues practice a reverse order system (or a derivate of the same) whereby the team that finished last in the season immediately before the draft gets awarded the first pick followed by the second last (Chandrakumaran, 2020). After all competing teams make their respective choices (also called a round), the process is repeated. The principle governing the draft aims to cyclically alter the fortunes of each team in the league assuming they all intend to maximise their wins (Tuck & Richards, 2019). Though some teams might aim to maximise profits, maximising wins will correlate to this objective through fan engagement, commercial partnerships, and brand value appreciation. The picks themselves essentially serve as financial assets that teams could realize either by selecting a player from the talent pool or exchanging them for other picks (both in the current draft or the future) and players or a combination of both. Whilst this allows teams to efficiently exchange selections between themselves, studies have shown teams in the National Football League (NFL) tend to overvalue the picks that are thus endowed upon them when comparing draftee payments and expected outcomes (Massey & Thaler, 2013). This inherently leads to a behaviour known as 'escalation of commitment', whereby decision-makers maintain (or increase) their commitment to a decision they made in the past, even when the marginal cost outweighs the marginal benefit (Staw, 1976).

In the professional sporting context, one could assume any win-maximising team would only retain players in their roster that could effectively contribute to this shared goal. Some might retain players for their brand value, though in the long-term teams will have to weigh in the opportunity cost of holding on to so such players in lieu of making a concentrated effort towards building a championship winning team. However, Staw and Hoang (1995) contradicted this predisposition finding teams within the National Basketball Association (NBA) gave more playing time and are more likely to retain players selected early on in the player draft, irrespective of their marginal productivity. The authors coined this behaviour as 'sunk investment play', given decision-makers throw good money after bad to justify the initial sunk cost of drafting the player (similar to the disposition effect in behavioural finance literature (Weber & Camerer, 1998)). Researchers have reaffirmed this phenomenon in the NBA (Coates & Oguntimein, 2010; Groothuis & Hill, 2004; Keefer, 2021) and other sporting competitions such as the NFL (Hendricks et al., 2003; Keefer, 2017), National Hockey League (NHL, (Farah & Baker, 2021)) whilst Borland et al. (2011) showed minimal effects in the Australian Football League (AFL). However, Chandrakumaran (2021) concluded that this effect might prevail in the AFL as the difference between inferred and actual value was lesser for early picks (similar to the NFL (Massey & Thaler, 2013)). This was attributed to the overutilisation of players selected early on in the draft to justify the initial choice. Still, one could question if similar behaviours were exhibited when such players were obtained through traded picks. Furthermore, if the same pick was traded multiple times before it was exercised to choose a player, would the previous behaviour remain the same.

The existing literature in behavioural economics provides some foundation in conceptualising the decision-making process with uncertain prospective payoffs. As per the expected utility theory, a rational agent would choose the best option by comparing the expected utility of each outcome (von Neumann & Morgenstern, 1944). However, upon evaluating the numerous behavioural biases leading to sub-optimal decision-making, Kahneman and Tversky (1979) concluded that agents are generally loss averse (not risk averse) and feel the impact of losses greater than an equivalent gain (commonly referred to as prospect theory). Their theory suggested agents generally comprehend these gains and losses compared to a reference point that is subjective to each individual and situation, causing their decisions to be made in relativity and not in absolutes. This inherently creates a situation called the endowment effect, whereby agents are highly likely to retain the ownership of an object they would not otherwise own. Studies have attributed such behaviours to under weighing the opportunity cost of possessing it (Thaler, 1980) caused by the psychological inertia governing their initial purchase decision (Gal, 2006). In such situations, if an owner is inclined to sell the object, the price at which they are willing to part ways is usually higher than the price prospective buyers are disposed to offer (Kahneman et al., 1990). Amidst such disequilibrium, should a sale happen, the buyer's reference point for the gain-loss asymmetry will shift relative to the existing point or status quo (Bleichrodt, 2007; Schmidt, 2003) and we would expect that effect to be compounded across every subsequent chain event (Morrison, 2000).

Should the same behaviour be observed within the pick trading market, when a team is allocated picks in the draft based on a pre-approved system, the reference point used by teams to adjudge trades could be higher, showcasing the endowment effect. A previous study explored this phenomenon within major sports drafts in North America and found strong evidence of this effect whereby teams would recoup the original picks which were appropriated to them by the league, though they may have previously exchanged them (Hobbs & Singh, 2022). However, if the initial team to whom the picks were initially endowed by the league choose to trade the picks, the effect will be compounded on players selected through traded picks with each subsequent exchange as the seller's premium increases as shown in Figure 7.1 (where draftee tenure is used as a proxy to quantify the endowment effect). That is to say, if team B trades up and purchases a pick from team A in exchange for a group of B's current picks, and team B uses the pick to select a player, team B will hold the player irrespective of their marginal productivity longer than team A. This is because the value demanded by team A to release a pick it was originally endowed by the league to team B would be higher. Hence team B will need to justify the excess and thereby hold the player longer. Building on this, should team C trade the same pick from team B that was originally obtained from team A, team C will hold any player they select using that pick longer than either teams A or B, had they exercised the pick themselves. This paper thereby aims to test the hypothesis wherein the endowment effect would compound when the pick used to select a player is traded between teams.

Figure 7.1: Conceptual model of the hypothesis



7.2 Data & Methods

In order to evaluate this hypothesis, we used the case of the AFL player draft due to both its uniqueness as a sport and its effectiveness in the trade market. Unlike the North American sporting codes, the AFL has a smaller draft (NFL and NHL draft has in excess of 230 picks, whereas the AFL draft averages less than a 100) and requires teams to maintain a smaller roster (NFL allows a 90-man list in the off season which could be weaned to 53 at the start of the season) indirectly achieving rank order selection parity (Chandrakumaran, 2021). This ensures all agents effectively evaluate potential recruits minimising the effect of alternative motives on their choice. Furthermore, as Australian rules football has 18 players per team in the field of play, the effect a single player would have on the outcome of a contest will not be significant, unlike the NBA, making the list of potential recruits largely homogenous (Chandrakumaran, 2021). Teams are awarded selections based on their reverse order season standing with the club finishing last having the first pick, followed by the second last. After each team (currently 18 teams) successfully selects a player, the process is repeated approximately three more times. The order of selection can be influenced by a variety of other rules, such as free agency compensation (when teams are awarded additional picks when there is a net outflow of veteran players in the trade period) and priority picks (when the league awards additional picks to support teams which consistently perform below par). In addition to this, teams are also allowed to trade picks with other clubs, for pick(s) in the current year or one year into the future, active players, or a combination of both. However, until recently, a majority of picks were traded for players. Players selected through the draft are usually signed on for two seasons (AFL, 2017). At the end of year two, the player will be restricted from moving to another team unless the team delists him. If the player is re-signed by the team, they can continue playing with their original team. Otherwise, the player can solicit offers from other clubs or re-enter the draft. It is important to note that player salary and contract information is not made publicly available in the AFL.

Data on all AFL draftees selected between 2003 and 2016 was obtained from Sorensen Technologies (a third-party data agency that provides data for the gambling industry sourced from the AFL) together with their subsequent performance from 2004 to 2017 (this was cross referenced to other open-source sites such as www.afltables.com). Trade related data was compiled from www.draftguru.com.au. Also, as some non-amateur players are selected at points not consistent with their post draft performance, rookie elevations (teams wishing to move players from their rookie list to the seniors will use picks later on in the draft which may not accurately reflect their profiles) and players who have played before (if a player is delisted from a team and isn't able to secure a position with another club in the trading period, they are allowed to enter the draft talent pool), were excluded from the sample (as done in previous studies (Chandrakumaran, Stewart, et al., 2023)). In addition, those selected after pick 73 were also removed from the analysis to ensure a uniform end point similar to the AFL's draft value index (DVI, The DVI was introduced in 2015 by the league to facilitate the Father-Son and Club-Academy rules by appropriating a numerical value for each selection in the draft. The index was created by fitting the career compensation of draftees selected over fifteen years (AFL, 2015a).). This yielded a sample of 905 draftees.

Table 7.1: Trade summary of all draft picks within the sample

Description	No. of Picks	No. of All Traded Picks	Avg. Times Traded	% Of Traded Picks	No. of Traded Picks per Times Exchanged		
					1	2	≥3
Total	905	335	1.49	37.02%	218	88	29
Picks							
1 to 5	70	9	1.11	12.86%	8	1	-
6 to 15	140	44	1.27	31.43%	36	6	2
16 to 30	209	81	1.46	38.76%	49	28	4
31 to 45	203	88	1.73	43.35%	46	30	12
46 to 60	180	77	1.52	42.78%	53	14	10
61 to 73	103	36	1.31	34.95%	26	9	1

Table 7.1 shows the exchange rate of all picks within the sample. In total, 37% of all draft picks changed hands prior to the selection of a player, of which each pick was traded 1.49 times on average. 218 of these were traded once, 88 twice, and 29 three or more times. The breakdown also shows picks between 31 and 60 were on average traded more often. As the top five selections seldom moved, it reinforces findings from previous studies which have shown the correlation of endowment effects to such early picks (Barake et al., 2018).

Figure 7.2 shows the proportion of players who exit from the team that drafted them and their career respectively plotted against their experience. Both show a negatively skewed relationship demonstrating the behaviour of teams removing players after the expiry of their initial contracts (Chandrakumaran, Larkin, et al., 2023). The figures also show that in most years, players selected through traded picks are less likely to exit both the team that originally drafted them and the league (Figure 7.2, note: 52% of the draftees observed within the sample were still actively playing in the league as of 2017). This observation reconciles with the hypothesis, whereby players selected through traded picks tend to last longer within the league.

Figure 7.2: Percentage of players released by their drafting teams and exiting the league each year post draft

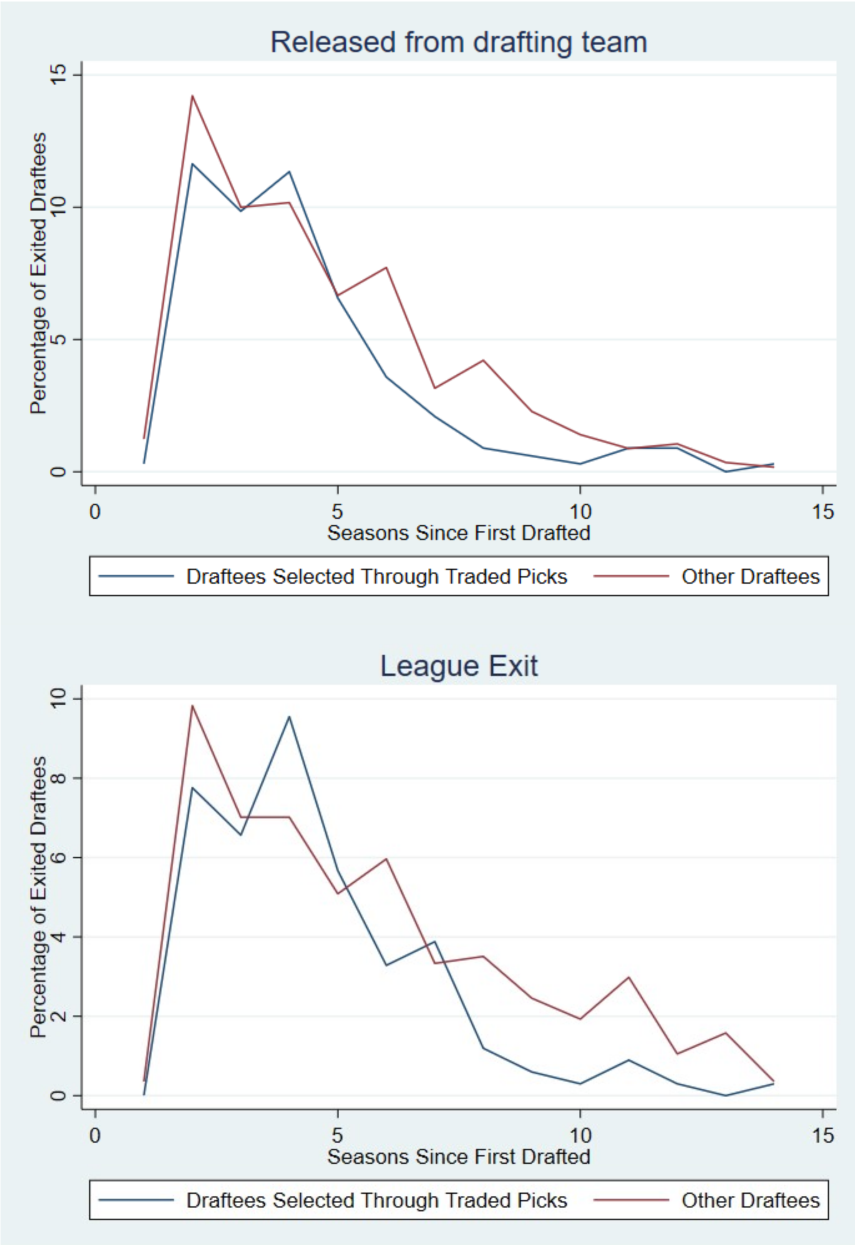


Table 7.2: Mean analysis within groups of traded picks

Mean Variable			Career Length with Drafting Team		Total Career Length	
Multivariate tests of means between traded and non-traded picks						
Wils' Lambda			0.959***		0.936***	
Pillai's Trace			0.041***		0.064***	
Lawley-Hotelling Trace			0.043***		0.068***	
Roy's Largest Root			0.043***		0.068***	
Times Traded	Avg. Pick	Obs	Mean	Std. Err.	Mean	Std. Err.
0	32.044	570	4.974	0.122	5.909	0.141
1	36.032	218	4.092	0.181	4.564	0.191
2	36.534	88	3.659	0.268	4.068	0.306
≥3	39.828	29	2.966	0.487	3.138	0.524
Within Group (Times Traded)		Degrees of Freedom	T-stat		T-stat	
0 & 1		786	3.879***		5.241***	
0 & 2		656	3.994***		4.870***	
0 & ≥3		597	3.624***		4.361***	
1 & 2		304	1.305*		1.384*	
1 & ≥3		245	2.141**		2.554***	
2 & ≥3		115	1.273		1.520*	

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

Table 7.2 shows the difference in draftee career tenure based on the number of times the picks used to select them were traded beforehand. The multivariate test of means shows significant variations in career length between those selected using traded and non-traded picks. However, the means themselves suggest smaller career lengths for those selected through traded picks, which is contrary to the proposed hypothesis. Yet, as shown in Table 7.1, most picks which are traded seem to be situated later on in the draft, the corresponding career tenures of players selected through such picks might be comparatively low. This is also observable in the average pick number of the selections exchanged displayed in Table 7.2. The average pick number used by teams exercising their own picks stood at 32, whilst picks exchanged once or twice averaged to 36. Finally, the t-test results for variances of career tenures between draftees selected using non-traded picks and picks which were traded once shows significant variation, similar to those traded more than once. However, their significance reduces when comparing draftees selected using picks traded once and twice or twice and thrice.

Given the research question aimed to be answered here looks at the difference in career lengths based on the nature of the picks used to select them it is important to control the data to account for active players as they might not reach the failure event. Hence, the sample was defined as a survival data series setting the longevity of players (in number of seasons) as the time variable and a binary variable with a value of 1 for those who have been delisted or retired and 0 for those still active in the league as the failure event. This was used to generate Table 7.3 which displays the incident rates (number of failure events divided by the total time) stratified by picks groups and the number of times the picks were traded. Ideally a lower incident rate would be preferred by draftees as it means more players do not reach the failure event leading longer careers within their teams. When looking at the career prospects of a player selected within picks 31 and 45, the incident rates decrease as pick used to draft player exchanges more hands. The same cannot be inferred from early picks (6 to 15). This reconciles with the previous assertion alluded to in Table 7.2, where the mean career tenures of players selected through traded picks were lower than those selected through non-traded picks as most trades happen later on in the draft.

Table 7.3: Incident rates of draftees selected at various points in the draft based on the number of times their picks were traded

Picks		No. of Times Picks were Traded			
		0	1	2	≥3
1 to 5	Career with Drafting Team	0.066	0.107	0.000	-
6 to 15		0.100	0.091	0.143	0.167
16 to 30		0.113	0.116	0.101	0.042
31 to 45		0.141	0.143	0.095	0.094
46 to 60		0.167	0.207	0.125	0.182
61 to 73		0.224	0.141	0.053	0.000
1 to 5	Total Career	0.028	0.000	0.000	-
6 to 15		0.051	0.045	0.107	0.111
16 to 30		0.078	0.073	0.087	0.042
31 to 45		0.100	0.116	0.063	0.088
46 to 60		0.136	0.179	0.097	0.182
61 to 73		0.189	0.120	0.000	0.000

However, pick number alone cannot be used to evaluate the prospect of a player, as a player's utility to a team would be a product of many competing factors, such as position played, physical metrics, on-field performance, and team requirements. In order to verify this theory, two Cox proportional hazard models were estimated. Unlike a conventional binary model (logit or probit), the Cox proportional hazards model would easily differentiate past and current players based on their career lengths (which is a proxy for the year in which the player was selected). The explanatory variables included the pick number used to select the player. The contribution to margin of victory (CMV) in the team that drafted them and in their overall career was added as a performance variable to justify the retention of a player across multiple seasons. The CMV metric was obtained by regressing the difference of a set of on-field metrics such as kicks and marks, which translated to point differences in each regular season AFL game between 2003 and 2017, similar to comparable models prevalent in the literature (Robertson, Back, et al., 2016; Stewart et al., 2007; Sullivan et al., 2014) (it is worthwhile noting that AFL's official player rating system (Champion Data Player Ratings) was also developed using a similar method). After refining the predictors using a stepwise analysis accounting for the Bayesian Information Criterion (BIC), the coefficients were used to extrapolate the career and seasonal CMV per draftee used in this study both in their overall career and their career with the team which initially drafted them. Coincidentally, previous studies which have used CMV to evaluate draft outcomes showed no significant difference between players selected through traded and non-traded picks (Chandrakumaran, 2021), suggesting career tenures to also be the same in a rational setting. However, we chose to interact this term with the position played (though there are multiple positions in Australian rules football, this study uses the main four groups which are defenders, forwards, midfielders, and ruckmen) by the player as the opportunity for players to create scoring stats is not evenly distributed across all positions. Initial iterations of the model used games played or time on field (in minutes) instead of CMV. However, with previous studies suggesting the decisional biases behind the use of players on field and their ineffectiveness in predicting performance, the CMV variable was used in the final model (Chandrakumaran, 2022; Gogos et al., 2020). The list was further compensated by indicators for race (indigenous players recruited through the draft have known to outperform their counterparts (Mitchell et al., 2011)), Father-Son (F/S) selections prior to 2007 (teams who have selected sons of former players prior to 2007 were required to nominate the player using a third round draft pick which did not always correlate to their expected outcomes (Stewart et al., 2016)), and drafting team. The primary count variable for this study, number of owners, was used to show how many teams had the selection before a player was ultimately chosen. All picks will have a value of one by default, unless they were traded, where it will be replaced by two or more based on the number times they were exchanged. The natural log of this count was used to show the increase in endowment effect with each trade at a diminished rate (Shephard & Färe, 1974). For the hypothesis to hold the coefficient of the owner variable should yield a negative value.

7.3 Results

As per the results shown in Table 7.4, all the control variables used in the models concurred with the existing literature. The positive coefficient attracted by the pick (the pick variable was tested in alternative forms such a quadratic and natural log yielding similar results) suggested a direct monotonic relationship between pick and career length as players selected early on in the draft would last longer compared to their counterparts (Staw & Hoang, 1995). F/S recruits prior to 2007 remained in par with their counterparts suggesting that whilst their pick number might not represent post draft outcomes, their tenure within the league might not be affected by it. Indigenous players did have a shorter career than their peers. This might not necessarily be due to underperformance, as studies have shown such players to be more productive (Mitchell et al., 2011), but rather due to the longer transition time in assimilating indigenous players within the league (Light et al., 2019, 2021; Nicholson et al., 2011). On the other hand, when draftees effectively contribute to the team as represented by their CMV, it reduces their chances of leaving. Midfielders and forwards reduced the chances of exiting the drafting team by 0.002 per CMV, whilst defenders and ruckmen did so by 0.003 and 0.004 per CMV respectively. The slightly higher values attributed to defenders and ruckmen was due to the inability of such positions to effectively contribute towards scoring outcomes unlike forwards and midfielders (Barake et al., 2022). However, since a player's contribution to a team's chances of winning generally follows a normal distribution (similar to a bell curve) over their overall tenure (Chandrakumaran, Stewart, et al., 2023), an indirect linear relationship between CMV and tenure could not be inferred. After peaking at a certain point in their career, veteran players would either resign or be replaced by teams to ensure continuance. Interestingly when both games played and time on field (in minutes) was used instead of CMV, a similar outcome was observed. Apart from Geelong, most drafting teams remained neutral in the first model, but yielded positive results on the career model.

Table 7.4: Regression results for the endowment effect model

Model Type	Cox Proportional Hazard Model			
Dependent Variable	Career Length with Drafting Team		Total Career Length	
Model Number	(7.1)		(7.2)	
Independent Variables	Coefficient	Std. Err.	Coefficient	Std. Err.
Pick	0.005*	0.002	0.012***	0.003
Indigenous	0.352**	0.168	0.367**	0.183
F/S <2007	0.291	0.278	0.316	0.301
ln(No. of Owners)	***-0.269****	***0.113***	***-0.076***	***0.122***
Interaction of CMV acquired whilst employed by the Drafting Team with Player Position				
Defender	-0.003***	0.002		
Forward	-0.002***	0.001		

Midfielder	-0.002***	0.001		
Ruckman	-0.004***	0.001		
Interaction of CMV acquired across total career with Player Position				
Defender			-0.003***	0.002
Forward			-0.002***	0.002
Midfielder			-0.002***	0.001
Ruckman			-0.005***	0.001
Drafting Team [a]				
Brisbane	0.284	0.240	0.480*	0.281
Carlton	0.359	0.248	0.945***	0.279
Collingwood	0.105	0.256	0.536*	0.293
Essendon	0.020	0.252	0.722**	0.284
Fremantle	0.037	0.254	0.810***	0.284
Geelong	-0.582**	0.262	-0.238	0.301
Gold Coast	0.071	0.358	0.484	0.421
Greater Western Sydney	0.333	0.318	-0.718	0.623
Hawthorn	-0.354	0.265	-0.335	0.317
Melbourne	0.183	0.250	0.678**	0.286
North Melbourne	-0.058	0.261	0.555*	0.293
Port Adelaide	-0.394	0.266	0.342	0.292
Richmond	-0.035	0.254	0.459	0.283
St. Kilda	0.084	0.283	0.721**	0.323
Sydney	-0.055	0.262	-0.226	0.303
West Coast	-0.396	0.288	0.242	0.314
Western Bulldogs	-0.191	0.261	0.132	0.299
No. of Players	905		905	
No. of Failures	526		433	
Log likelihood	-2831.784		-2224.600	
LR Chi^2	621.870		704.470	
Prob > Chi^2	0.000		0.000	

[a] Reference team is Adelaide

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

The key finding of this model is that a player's longevity with their drafting team, significantly reduces with every trade (or new owner) at a diminishing log normal rate of -0.269 (significant at 0.05). Interestingly when the same variable was set as an indicator variable, the individual coefficients for each step followed a log normal increase as well. This corresponds with the hypothesis that a team would retain a player it selects through the draft if the pick used to select the player was acquired through a trade. However, the same effect wasn't observable across the player's career. When such drafted players eventually move to different teams in their career, this effect could be minimised as the initial investment into the player went only with the team that drafted them and not the subsequent teams that the player moved on to. On a practical standpoint, managers should hold a player in their lists based on their marginal productivity (both on and off field). However, when the initial investment to trade up (i.e., procuring the pick) has a higher cost base, the reluctance on the decision maker's end on riding the option is understandable. In order to avoid such a dilemma, the best course of action would be to ensure all trades are made in alignment with their club's valuation of each pick, as the subsequent mentality to hold is a product of the first (especially when the same pick has changed hands before).

7.4 Discussion

The endowment effect is a decisional irrationality that exists in all facets of human life (Staw, 1976). When applied directly to the player draft, existing literature within the NBA has shown how decision-makers retain drafted players irrespective of their marginal productivity in order to validate their previous resolve (Staw & Hoang, 1995). This effect was further evident amongst players drafted early on the system as they would have a higher level of emotional investment (Chandrakumaran, 2021; Massey & Thaler, 2013). The lower number of trades observed in the first five picks further shows the prevalence of the endowment effect as teams were unwilling to deal on trades including these selections. The findings from this study fails to falsify the theory upholding the proposed hypothesis. Interestingly, this effect still manifests even amongst teams that only acquired the right for the pick.

Kahneman et al. (1990) suggested the endowment effect might prevail even if there is no cause for attachment (or recently obtained/purchased). Furthermore, when a pick is traded, the value demanded by the original owner is usually higher. This results in a situation where the reference point of the subsequent owner moves further to the right (on a cartesian plane) as it has to account for the premium exchanged to acquire the pick. This could cause teams to inherently increase the value of the pick they recently acquired (if they intend to re-trade it) or retain any player they obtain through the pick for a longer period of time than the original owners might have. Whilst this behaviour might seem to exacerbate the endowment effect that already exists within the league, it is important to note this compounding anomaly is caused mainly due to the existence of the original effect.

While the results from this study have affirmed the hypothesis put forward, the model could be further improved. These could include modifications for changes in team decision makers (i.e., general managers and head coaches), injury lists and overall players salary cap management. Also, the timing between trades could play a part in the emotional attachment decision makers have. For example, a team that acquires a pick and trades it immediately might not necessarily demand a higher value in return when compared to another team which might have held the pick for a few days. Moreover, as the AFL started allowing teams to trade picks up to one year in the future (Bowen, 2015), 'trading up' ought to be clearly defined as conventional wisdom suggests it to be the earliest pick in each trade. However, when teams trade into the future, an early selection from next year exchanged for a few late selections from today might misappropriate the notion behind the trade. Furthermore, though our work fails to falsify prospect theory, and by extension the endowment effect, it is important to note that agents behave more rationally as they gain experience within competitive markets (List, 2004). Still, when buyers and sellers exchange goods and services at or close to the market price, the effect could be minimalised (Weaver & Frederick, 2012).

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How Did the AFL National Draft Mitigate Perverse Incentives?

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3. CO-AUTHOR(S) DECLARATION

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Abstract

Similar to the National Basketball Association (NBA) and the National Hockey League (NHL), the reverse order nature of the Australian Football League (AFL) national player draft has often times been speculated to induce tanking. However, a prior study found that there is no evidence of tanking within the AFL. This study tests this assumption under four periods, namely pre-2006, 2006-2011, 2012-2014 and post 2014, to reflect the changes in rules. While the results concur with the previous study, the behaviour of teams in the priority pick era of the draft finds evidence to the contrary.

Keywords

tanking, priority pick, DVI, probit, competitive balance

8.1 Introduction

"... No team can be successful unless its competitors also survive and prosper" (Rottenberg, 1956). In order to circumvent any form of excessive dominance by one team, sporting leagues have resorted to implementing a suit of competitive balance policies, which would allow *"... every well-run club to have a regularly recurring reasonable hope of reaching postseason play"* (Levin et al., 2000). However, these mechanisms do tend to create tensions between the league's intention to make the competition equitable, and the team's incentive to engage in its self-interest to exploit such policies.

Tanking is one such situation in which teams that do not qualify for post season play, intentionally lose end of season contests in order to obtain a form of compensation that is often times allocated to poorly performing teams. Taylor and Trogdon (2002) were the first to report such incentives within the National Basketball Association (NBA), due to the reverse order player draft system that was in existence at the time. A reverse order player draft meant that the team with worst record gets to make the first selection in the upcoming draft which assigns amateur talent to professional teams. The order of selection thus causes teams to deliberately misconstrue their league standing in order to obtain an unfair advantage in a system that was meant to be an equitable arbitrator of resources. Walters and Williams (2012) went on to confirm this incentive in the NBA, while studies affirmed the existence of the same within the National Hockey League (NHL) as well (Fornwagner, 2018; Gold, 2011). In response to this, many authors have suggested alternative means by which the draft order should be ascertained (i.e. other than the reverse order system) (Gold, 2010; Tuck & Whitten, 2013).

This paper thereby intends to evaluate the Australian Football League's (AFL) national player draft, and its compliments in creating perverse incentives for non-post season qualifying teams to 'tank' end of season contests. Borland et al. (2009), visited this question and deemed that no such evidence existed within the AFL, while Lenten et al. (2018) suggested to the contrary based on the alternative draft pick allocation model which increased the win probability of teams that were eliminated from the finals (top 8 teams in the regular season ladder). This study thereby aims to investigate the prevalence of perverse incentives within the AFL, under the reverse order selection model, the special assistance priority picks and the recent draft value index (DVI).

The findings suggest that there is no evidence of tanking in the AFL in relation to the reverse order nature of the draft itself and the DVI; however, the priority picks did create some perverse incentives until 2012, where it was later appointed to the discretion of the league.

8.2 The AFL National Player Draft

The AFL national player draft is often dated back to 1986, where the then Victorian Football League (VFL) gave teams the opportunity to select amateur players from their retrospective zones. Selection order within the draft was based on a conventional reverse order season standing system similar to those observed in major North American drafts. Inherently this means that a team which finishes last in the regular season (excluding the finals) immediately prior to the draft will have the first selection, followed by the second last until a complete round of selections is complete. This process will recur continuously for approximately four more rounds in the current version of the draft. Although the draft is not the only way by which clubs recruit players, it still remains to be one of the league's primary and effective competitive balance measure (Booth, 2004).

Since then, the AFL has introduced many other competitive balance policies to the draft, diluting the selection order from a pure reverse order draft to a more complex venture. The policies tied into the current version of the draft include, free agency compensation, father-son rule, club-academy rule, priority pick rule, foundation selection and penalties for misconduct.

As the hypothesis of this study is to analyse the prevalence of perverse incentives in the reverse order draft, the special assistance program provided by the priority picks, and the 2015 bidding system, the following sections will provide an understanding into these mechanisms.

8.2.1 Priority Pick Rule

Priority picks were first introduced in 1993 as teams such as Sydney, Brisbane and Richmond suffered prolonged periods of poor performance. To assist such teams, the league compensated them with priority picks before the beginning of the national draft, in addition to their existing selections, giving them prime opportunity to procure the best talent. This system was further set as a recurring rule, whereby teams that have less than 20.5 premiership points (i.e. five wins)[31] in any given season were automatically made eligible for priority picks. Thereby each team within this category will receive an additional pick which will be allocated at the beginning of the draft in the same reverse order standing. For example, if Carlton and Richmond finished at the 18th and 17th spots in the league table and were both eligible for priority picks, both teams will receive the 1st and 2nd picks in the draft. Thereafter, the regular draft will allocate further selections to each team, giving Carlton and Richmond access to picks 3 and 4, followed by the rest of the teams in their reverse order season standing.

However, with increased speculation into tanking, the league reformed the eligibility criteria for priority picks in 2006, making teams with less than 16.5 points (i.e., four wins) for two consecutive years eligible for these picks. The continuity factor implemented by this amendment made any tanking effort clearly observable, as displayed by the 2007 round 22 contest between Melbourne and Carlton and the 2009 round 18 game between

[31] A win is equal to four premiership points in the AFL, while draws are losses are awarded two and none.

Melbourne and Richmond, with Melbourne being fined 500,000 Australian dollars for bringing the latter into dispute, even when they were not found guilty (Cooper, 2013).

As of 2012, the AFL Commission revised the 2006 rule to have absolute power in order to award priority picks on a discretionary basis and not on a predefined formulae which could induce tanking. The only team to receive priority picks since the latest rule change was Brisbane in 2016.

8.2.2 Draft Value Index (DVI)

The AFL has had a long-standing tradition of promoting itself as a family oriented sport and has always invested in expanding its reach throughout Australia. In order to fulfil this objective, the league has promoted two priority access exceptions enabling teams to recruit players, known as the father-son and club-academy rules. Under the father-son rule, a team is allowed priority access to sons of former players of the same team, while the club-academy rule provides the same benefit for teams that wish to recruit a player from their own club amateur player academies. Normally, teams will use a selection within the draft to procure such players. However, if another team contends for the same player before the priority access team, the latter was given the opportunity to move up the draft and select the player in question, by sacrificing their next available selection. For example, let’s assume that early into the draft Carlton has picks 19 and 37 and are eyeing a rookie who is the son of a former player. If Richmond contests for the same player at pick 5, Carlton can promote itself to pick 5, select the player, push Richmond down one spot and forgo its 19th selection. Due to this inequitable mismatch, the AFL created an index assigning market values to each selection in the national draft, similar to the pick value chart (PVC) in the National Football League (NFL). This index provided teams that were bidding for these special category players, a suitable currency for trading and matching bids. Now if Carlton wanted to procure the father-son player discussed in the earlier example, they will have to forgo the DVI points of the 5th pick from their share of picks in the whole draft. However, given the log normal curvature of the DVI (refer to slide 6 in AFL (2015a)), initial picks are priced with a higher mark-up which is incompatible with the draftee’s future performance (Mitchell et al., 2011; Stewart et al., 2016). Massey and Thaler (2013) questioned a similar phenomenon with the NFL’s PVC, which overvalued the early picks and undervalued the latter, causing inefficient labour markets. Irrespective of these claims, for the purpose of this study, the higher price tag of the initial picks is also considered as a perverse incentive to induce tanking. For more information on the DVI and the bidding system, please refer to AFL (2015a).

8.3 The Data

To assess the prevalence of the tanking phenomenon, data on all matches from 2003 to 2017 was gathered. This information was supplied by Sorensen Technologies and supplemented using third party websites (including footywire.com and afltables.com).

Table 8.1: Description of the variables used

Data	Description
HW*#	Home Win
RT	Rounds remaining in the home and away season
HAM	Home team league ladder position minus away team league ladder position
HT4*	Home team is either within the top 4 or have the opportunity to be within the top 4 in the league ladder at the end of the regular season.
AT4*	Away team is either within the top 4 or have the opportunity to be within the top 4 in the league ladder at the end of the regular season.
HT8*	Home team is either within 5 and 8 or have the opportunity to be within 5 and 8 in the league ladder at the end of the regular season.
AT8*	Away team is either within 5 and 8 or have the opportunity to be within 5 and 8 in the league ladder at the end of the regular season.
HE*	Home team is eliminated from the top 8
AE*	Away team is eliminated from the top 8
HE!>20*	Eliminated home team with more than 20 league points
AE!>20*	Eliminated away team with more than 20 league points
HE!20,18*	Eliminated home team with 20 or 18 league points
AE!20,18*	Eliminated away team with 20 or 18 league points
HE!16,14*	Eliminated home team with 16 or 14 league points
AE!16,14*	Eliminated away team with 16 or 14 league points
HE!12,10*	Eliminated home team with 12 or 10 league points
AE!12,10*	Eliminated away team with 12 or 10 league points
HE!<10*	Eliminated home team with less than 10 league points
AE!<10*	Eliminated away team with less than 10 league points

* Category variables with 1 for yes and 0 for no.; # The chosen sample only had 11 instances of draws which were thinly spread across the four periods in question. However, these were also considered as home team losses for the purpose of this study.

The home and away contests within the specified threshold yielded 2,872 games for the purpose of this analysis. However, in order to constrain the pool to reflect each team involved in the contest to fall explicitly within one of the HT, HE!, AT, AE! categorical variables, only those games which occurred in the last six rounds of the season, which is 755, are considered hereon. These contests were further drilled down in to four time periods to consider the effects of the major policy changes affecting the draft, as explained earlier in section 8.2.1 and 8.2.2. 2003-05 represents the 1993 priority pick policy that was in place, while 2006-11, 2012-14 and 2015-17 respectively depict the 2006 and 2012 priority pick rule changes and the introduction of the DVI in 2015.

8.4 The Two-Part Elimination Model

Adhering to previous academic work (de Lorenzo & Grundy, 2016), a probit model was used to identify the cumulative distribution (ϕ) of the probability that the home team wins the game given its incentives and priorities as expressed by the categorical variables. Thereby the first model presented below provides the ϕ of $\Pr(HW = 1|X)$, where $\{X: X \in A\ HE, AE, HAM\}$. That is the probability that the home team will win the game if either it or the away team is eliminated from qualifying for post season play (please refer to Table S8.1 for the regression results). The results were then approximated to a standard normal distribution are given below.

Table 8.2: ϕ of a two-part elimination interaction

Eliminated	*Both (HE & AE)*	*Home (HE)*	*Away (AE)*	*Neither*
2003-05	0.59	0.50	0.72	0.64
2006-11	0.56	0.62	0.54	0.60
2012-14	0.61	0.59	0.57	0.55
2015-17	0.72	0.57	0.76	0.62

The findings in Table 8.2 clearly states that irrespective of elimination, the home team is and always has been the favourite to win the game. However, upon further review we could observe that the ϕ of both the 2003-05 and 2015-17 time periods are somewhat similar suggesting that the effect of any productive equalisation measures undertaken in between has withered away due to the new DVI and the complementary bidding system. Under both scenarios, the home team has a considerable likelihood of winning, if the away team has been eliminated from the tournament, while similar conditions in between warranted for a somewhat fair chance of victory. Surprisingly, the ϕ of the home team winning in the 2006-11 and 2012-14 periods when the home team itself is eliminated is higher than the same when the away team is eliminated, which contradicts with rational choice.

Still the findings of this model do not either concur nor reject the hypothesis of this study that the AFL national player draft created perverse incentives for non-post-season qualifying teams to tank end of season contests in order to obtain better draft picks, increase their DVI points arsenal or accumulate priority selections as deemed by the AFL at the time, due to the lack of specificity of the interaction variables. Hence, we move on to the next model, wherein a multitude of category variables are used to identify the position in which each contesting team is at, prior to the start of the game.

8.5 The Multi Variable Situation Model

Similar to section 0 above, this model was also approximated using a probit regression.[32] Thereby the ϕ of Pr $(HW = 1|X)$ where $\{X: X \in HT4, AT4, HT8, AT8, HE! > 20, AE! > 20, HE!\,20{,}18, AE!\,20{,}18, HE!\,16{,}14, AE!\,16{,}14, HE!\,12{,}10, AE!\,12{,}10, HE! < 10, AE! < 10, HAM\}$ was calculated per reference period in Table S8.2. In a purely rational scenario, where match outcomes is based on skill and accumulated league points, the outcomes of a two part interaction of the home team's winning chances will be as follows.

[32] Retrospective fitting of a Brownian motion random walk model (Stern, 1994) was attempted as part of this study. However due to the specificity of the categorical variable interactions expected, and the lack of absolute representation, the choice was made to move forward with the probit model.

Figure 8.1: Rational Simulation of Pr(HW=1|X)

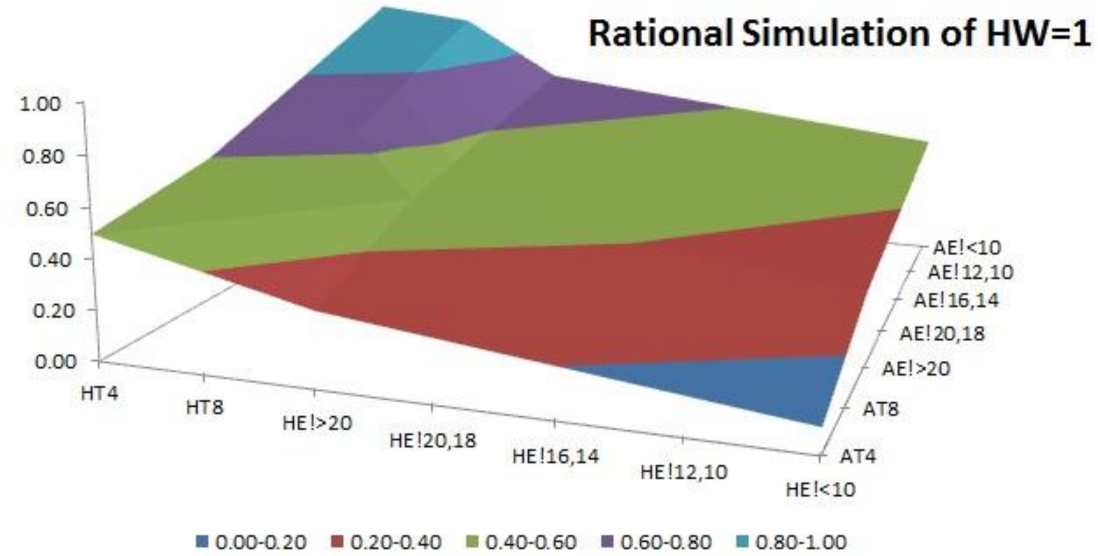


Figure 8.1 clearly represents an equal chance for victory, for teams of equal status (as defined by the category variables they fall into) not including any home field advantage. For example, a home team that has been eliminated from the top 8 and has more than 20 league points (HE!>20), will have a 50% chance of winning against an opposition of similar fortitude (AE!>20), while a team with top 4 prospects (HT4) will have nearly perfect odds of winning against an opposition which was eliminated and has less than 10 league points for the season (AE!<10). However, the models that were developed did not entertain the same principle as shown above.[33]

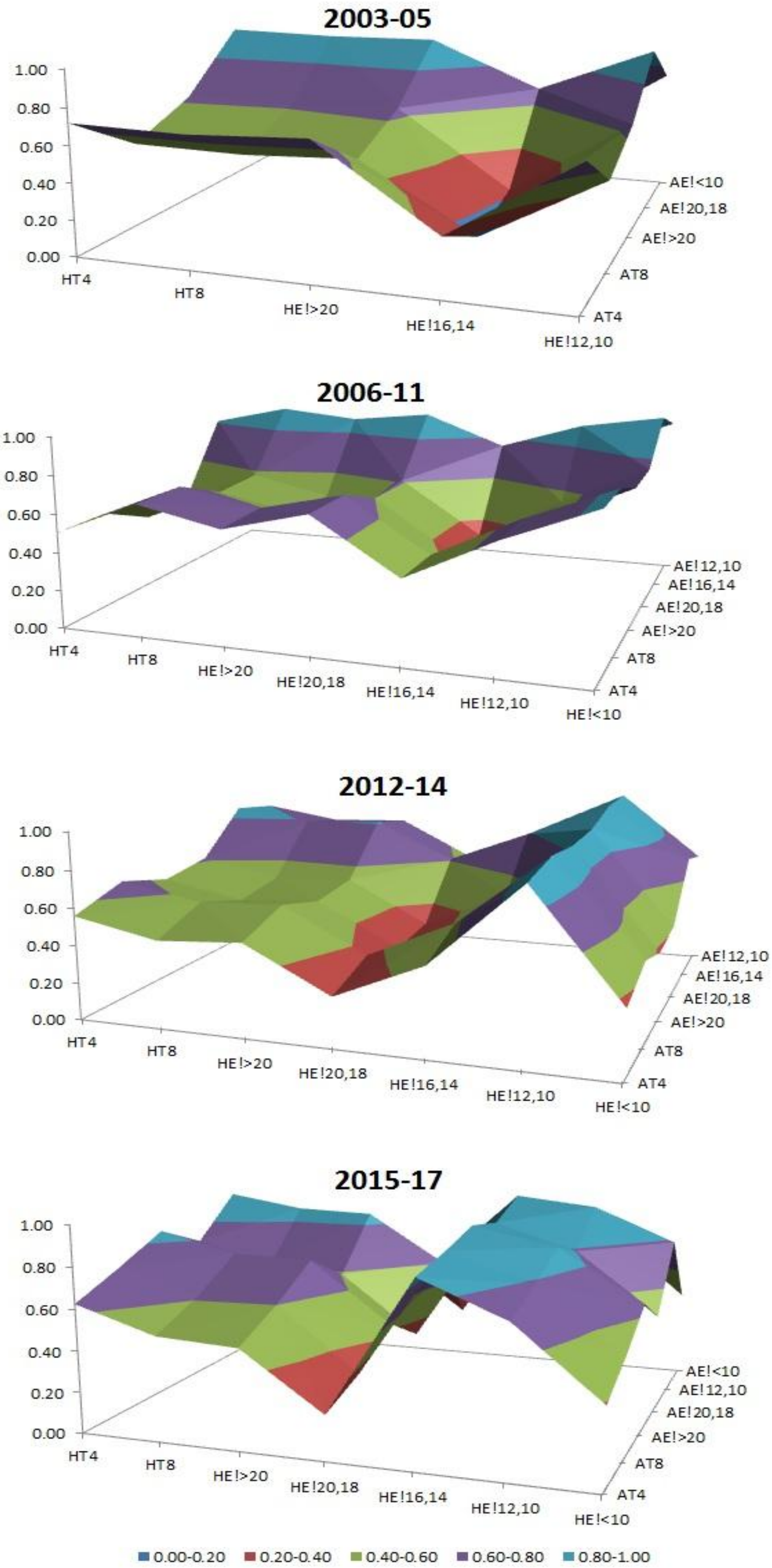
The 2003-05 model shows increased signs of tanking amongst teams that had premiership points between 20 and 14 before the start of the game. Moreover, teams with 20 and 18 points, clearly predicted the success of the opposing team, in order to ensure that they do not cross over the requirements of being eligible for priority selections in the upcoming draft. These findings warrant the league's speculation into the perverse incentives caused by the 1993 priority pick rule to tank.

[33] The actual ϕ are presented in Table S8.3 within the appendix.

The area plot for the 2006-11 regression changed dramatically from the intense hills and valleys caused by the previous rules, forcing the graph to flatten, inferring an equal chance of win. Still, this model also fails partly due to the existence of the priority pick rule which enabled teams with two poor consecutive seasons to access this special assistance. This is specifically noted in the lower and higher ϕ observed when the home and away teams have achieved either 16 or 14 premiership points prior to the start of the contest. Under both models, teams that do not fall under the priority pick threshold and have performed much worse in the season have higher (and retrospectively lower) chances of winning further affirming the conclusion in to tanking. However, the two-year rule in part did mitigate the incentive for teams to lose up to a certain extent.

The 2012-14 model analyses the post priority pick era, whereby the league has taken the burden of awarding this assistance at its own discretion. The area of the plot has flattened considerably when compared with the prior, however, there are two discrete anomalies to be noted. The first is the trench seen when the home team has been both eliminated and has either 20 or 18 premiership points, and the second is the considerable peak when the home team has either 12 or 10 points. This phenomenon is carried on to the 2015-17 model as well, while the latter has increased the win probability at all points except when the home team has either 20 or 18 league points.

Figure 8.2: Probit Estimation of Pr(HW=1|X)



8.6 Discussion

The findings presented in Figure 8.2 clearly presented evidence of tanking in the priority pick era of the league. However, there was no conclusive evidence that the same phenomenon was entertained by the reverse order nature of the draft and the DVI. The reasons for this are discussed below.

As the AFL national player draft is fairly new, when compared to its North American counterparts, teams have not yet settled in a recurring procedure of selecting the best talent in the order of performance. Moreover, if one could argue that they have ascertained the skill to identify talent, the relative importance of one player on the outcome of future contests could be minimal, as Australian Rules football is a team sport of 18 players. This principle could be validated using the NFL example as no study has concluded with evidence of perverse incentives within the league. The example quoted earlier only relates to the NBA & NHL, where the number of on field players is considerably less.

Moreover, Australian football is a local sport, which does not even dominate local viewership, as Australians themselves are split in allegiance between the AFL and the National Rugby League (NRL). Thereby the talent pool that is contested for in the draft is considerably less, and the importance of a better pick could be minimal.

With regards to the DVI, there still appears to be a contradiction of thought. Even though the valuation of picks is similar to the PVC that has been attested with ineffective labour markets, there is no concrete evidence that the post DVI AFL seasons present any signs of tanking, as home teams always have a higher likelihood of winning irrespective of their own standing in the league tables. This could be due to the fact that most AFL clubs still do not use the DVI as a suitable measure of market value in trading picks. Furthermore, when it comes to the bidding of father-son and club-academy players, the relatively low number of players who are eligible under this category, plus the ability of the teams to negotiate trades for better DVI points, as their terms are based on their assumption of market value and not the DVI, alleviates the team’s incentive to tank and accumulate picks with a higher DVI.

The main concern in the post priority pick era is the continued falling ϕ values when the home team is both eliminated and has either 20 or 18 premiership points. At this present time, there is no relevant mechanism that could be appropriated with the condition to be coined as tanking. On the contrary, the ever-increasing ϕ values for all home teams irrespective of their status in the league within the same period, solidifies the fact that there is no evidence of tanking within the AFL, apart from the priority pick era.

8.7 Avenues for Further Research

While the conclusions from this study have re-affirmed the fact that there is no evidence of draft induced tanking, a slight variation in the method has showed the incentive caused by the priority pick rule. This proves that even this model could be further tested and re-tested for improvement. The effects of the DVI itself are too early to be quantified as the teams have not fully ratified this idea into their drafting strategies. Meaning that after a suitable lapse of time (of five or more years), the hypothesis of the DVI causing perverse incentives ought to be re-tested.

Also as stressed in the previous discussion, the reasoning behind the fallout in the HE!20,18 category of teams provides a suitable avenue for further exploration. Moreover, the rise in ϕ post 2011 also raises concerns about the uncertainty of outcomes, which drives game day attendances. While the increased values of home teams with lower league points could be attested to the ‘nothing to lose’ playbook, the overall rise does raise some pivotal concerns as to the nature of home field advantage.

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Appendix

Table S8.1: Two-part elimination model

SEASON	2003-05	2006-11	2012-14	2015-17
VARIABLES	HW	HW	HW	HW
HE	-0.35	0.05	0.096	-0.12
	(0.26)	(0.18)	(0.26)	(0.25)
AE	0.23	-0.16	0.06	0.39
	(0.25)	(0.18)	(0.25)	(0.24)
HAM	-0.09***	-0.10***	-0.10***	-0.10***
	(0.02)	(0.01)	(0.02)	(0.02)
Constant	0.36**	0.27**	0.10	0.30
	(0.18)	(0.13)	(0.18)	(0.20)
Observations	144	287	162	162
Pseudo R^2	0.15	0.14	0.16	0.24

Coefficients reported; Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table S8.2: Multi variable situation model

SEASON	2003-05	2006-11	2012-14	2015-17
VARIABLES	HW	HW	HW	HW
HT4	-0.04	-0.24	0.16	0.35
	(0.38)	(0.25)	(0.36)	(0.39)
HT8	-0.08	0.23	-0.07	0.04
	(0.38)	(0.25)	(0.32)	(0.31)
HE!<10	Collinear	0.73	-0.34	-0.26
		(0.50)	(0.59)	(0.57)
HE!12,10	-0.00	0.15	1.29	0.57
	(0.76)	(0.39)	(0.87)	(0.55)
HE!16,14	-1.11**	-0.41	-0.07	1.12
	(0.52)	(0.43)	(0.51)	(0.78)
HE!20,18	Failure	0.29	-0.62	-0.77
		(0.42)	(0.63)	(0.59)
AT4	0.29	0.30	-0.03	-0.65**
	(0.38)	(0.23)	(0.33)	(0.31)
AT8	-0.39	0.31	0.22	-0.38
	(0.35)	(0.24)	(0.34)	(0.36)
AE!<10	0.14	Success	Success	-0.55
	(0.98)			(0.89)
AE!12,10	Success	0.43	0.65	0.43
		(0.50)	(0.78)	(0.76)
AE!16,14	Success	1.17*	0.86	Success
		(0.53)	(0.65)	
AE!20,18	1.24*	0.03	0.09	-0.40
	(0.72)	(0.40)	(0.47)	(0.51)
HAM	-0.07**	-0.10***	-0.07**	-0.10***
	(0.03)	(0.02)	(0.03)	(0.03)
Constant	0.35	-0.02	0.01	0.62***
	(0.24)	(0.15)	(0.22)	(0.23)
Observations	121	281	149	157
Pseudo R^2	0.17	0.17	0.18	0.26

Coefficients reported; Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table S8.3: ϕ of Pr(HW=1|X) displayed in Figure 8.2

2003-05	*HT4*	*HT8*	*HE!>20*	*HE!16,14*	*HE!12,10*
AT4	0.72	0.71	0.74	0.32	0.74
AT8	0.47	0.46	0.49	0.13	0.49
AE!>20	0.62	0.61	0.64	0.22	0.64
AE!20,18	0.94	0.93	0.94	0.68	0.94
AE!<10	0.67	0.66	0.69	0.27	0.69

2006-11	*HT4*	*HT8*	*HE!>20*	*HE!20,18*	*HE!16,14*	*HE!12,10*	*HE!<10*
AT4	0.51	0.69	0.60	0.71	0.44	0.66	0.84
AT8	0.51	0.69	0.61	0.71	0.44	0.66	0.84
AE!>20	0.39	0.57	0.48	0.60	0.32	0.54	0.75
AE!20,18	0.40	0.58	0.49	0.61	0.33	0.55	0.76
AE!16,14	0.81	0.91	0.87	0.92	0.76	0.90	0.97
AE!12,10	0.56	0.73	0.65	0.75	0.49	0.70	0.87

2012-14	*HT4*	*HT8*	*HE!>20*	*HE!20,18*	*HE!16,14*	*HE!12,10*	*HE!<10*
AT4	0.56	0.47	0.50	0.27	0.47	0.90	0.36
AT8	0.65	0.57	0.59	0.36	0.57	0.94	0.46
AE!>20	0.57	0.48	0.51	0.28	0.48	0.91	0.38
AE!20,18	0.61	0.52	0.54	0.31	0.51	0.92	0.41
AE!16,14	0.85	0.79	0.81	0.61	0.79	0.98	0.70
AE!12,10	0.80	0.73	0.75	0.53	0.73	0.98	0.63

2015-17	*HT4*	*HT8*	*HE!>20*	*HE!20,18*	*HE!16,14*	*HE!12,10*	*HE!<10*
AT4	0.63	0.51	0.49	0.22	0.87	0.71	0.39
AT8	0.73	0.61	0.60	0.30	0.91	0.79	0.50
AE!>20	0.84	0.75	0.74	0.45	0.96	0.88	0.64
AE!20,18	0.72	0.61	0.59	0.30	0.91	0.79	0.49
AE!12,10	0.92	0.86	0.85	0.61	0.99	0.95	0.79
AE!<10	0.67	0.55	0.53	0.25	0.88	0.74	0.43

Chapter 9: Final Remarks

9.1 General Discussion

As mentioned in the introduction, the AFL national player draft is a key measure embedded into the league's competitive balance policy (Booth, 2004, 2005). The reverse order selection mandate gives teams access to early selections which in turn allows them to boost their rosters towards becoming a premiership contender. Even if teams choose to exchange the picks allocated to them by the league, the value they could obtain in return (either through a combination of other picks and/or players) from the trade market would be of equivalent value. Thus, the league's expectation of ensuring an evenly distributed win-loss spectrum, discouraging the dominance of a select few is achieved (Masson et al., 2014). Still, the utilisation of the draft by all stakeholders involved in the process across other North American sporting leagues did show some concerns. These include, retaining draftees beyond their marginal productivity to justify excessive investments (Staw & Hoang, 1995) in the NBA, or even intentionally losing games to accumulate early draft picks (Fornwagner, 2018) in the NHL. However, a common thread observed in the literature leading to these behaviours relates to the misconception of pick value. To that effect, the overarching aim of this thesis was to develop an alternative model to value picks, players, and future contracts within the AFL national player draft, while analysing the effectiveness of the mechanism itself.

Unlike previous studies which have evaluated the AFL draft and its ability to induce a level of competitiveness to the overall league (Booth, 2004, 2005; Masson et al., 2014), the objective of this thesis, however, was to evaluate the mechanism itself in terms of its utilisation by the stakeholders. Due to the misconception of pick value, referred to previously, a few hypotheses were made to test the manner in which decision makers used the players selected through the draft and their incentives during season to strategically place themselves in the draft order. One such situation is the retention of players beyond their marginal utility (performance). Prior to verifying its prevalence, it is important to understand if the expected outcomes of draftees differed in any way other than the order in which they were selected. Ideally, in a scenario where two or more teams choose players in a revolving order, the sincere outcome ought to be Pareto optimal. However, Hersch and Pelkowski (2016) showed the performance of players selected through traded picks in the NFL did not necessarily coincide with their respective pick numbers suggesting a market inefficiency. This thesis retested this hypothesis within the AFL by modelling match-to-match performance of players selected through the draft in Chapter 6. The findings contradicted the NFL study whereby the performance of players selected through normal draft picks and those selected through traded picks remained the same displaying the parity expected in a Coasian world.

If the expected outcomes of players did not differ based on the nature of draft picks, the retention of such players should also not differ. This is to say, if the performance of a player selected through a pick which was traded up, is in par to that of a player selected through a non-traded pick at the same point, the tenure of both players should remain the same. Yet, the survival models specified in Chapter 7 showed significant variance amongst drafting team career tenures of players selected through traded and non-traded picks. As teams have been shown to overvalue early picks and trade up to acquire them, they end up exchanging a lot more in value to obtain such picks, solidifying their need to retain players picked using those picks even when their on-field performance does not warrant it. Whilst this finding did not reconcile with Chapter 6, such behaviour could be attributed to the misunderstanding of pick value referred to early on and the endowment effect discussed in the behavioural economics literature.

Whilst these misjudgements in pick value can lead to the inefficient use of players selected through the draft, the draft itself could also raise the potential for a perverse incentive. The common example used in the sporting world with reverse order drafts is the tanking of end of season games where teams eliminated from the playoffs intentionally lose games to get access to better (or earlier) draft picks (Fornwagner, 2018). Though Borland et al. (2009) refuted any such claim caused due to the AFL player draft, Chapter 8 explored the same question aimed at other policies tied into the draft (especially the priority pick system). This showed the prevalence of tanking in the first two versions of the priority pick rule whereby teams refrained from winning (or attempting to win) games that would take them over the threshold, which would make them ineligible for such selections. This further validated the need for ensuring any well-meaning competitive balance policy to be crafted in way which disincentivises behaviours in contraire to the spirit of the game.

In order to facilitate this, it was important to acquire an appropriate pick value system that could be used as an ideal benchmark. The prevailing body of knowledge provides numerous pick value systems derived from match-to-match performance metrics, compensation, and trade market equilibrium (AFL, 2015a; Massey & Thaler, 2013; Schuckers, 2011a). Whilst all these models provide guidance on the valuation of picks in the current year, the mechanics of the draft, however, allows it to be used in ways which aren't catered for by these systems. Like many other North American leagues, the AFL allows for the trading of picks for picks both in the current and future years together with active players.

For example, Brisbane traded Elliot Yeo to West Coast in order to obtain pick 28 before the 2013 draft. In order to facilitate trades between two different asset classes, such as picks and active players, any metric used should be easily adopted across both groups. After modelling the survival of players selected at various points in the draft, by extending the work of Glasson and Bedford (2009), the study in Chapter 3 mimicked the same with current players based on the number of games and seasons they were listed in the AFL. This helped create a common denomination that could be applied to both picks and players to facilitate the exchange of the same. When applied to the same example, in 2013, Yeo was worth a survival rate of 0.83 whereas pick 28 was worth 0.79 leaving both parties involved in the exchange a relative parity though West Coast did make a slight profit.

Another situation that could arise involves the trading of picks in the current year to those in the future, similar to the occasion where Richmond obtained pick 53 of the 2017 draft by forfeiting their third-round pick from 2018 (which turned out to be 58) to Geelong. Both Massey and Thaler (2013) and Taylor et al. (2018) determined an appropriate discount rate used in the NFL pick trade market across two decades assuming all such exchanges were at par. Should the same principle be applied here, the difference in value between the 53rd (233 DVI) and 58th (170 DVI) picks in the current year would be termed as the discount rate. However, given trade negotiations are influenced by a variety of factors including the immediate needs of the clubs involved, tenure of the decision makers, the team's previous win-loss record, it is safe to assume all trades do not reach a level of parity. Hence basing any discount rate on such perceived parity will only provide an understanding of market rates and not actual value. Building on the work of Chandrakumaran, Stewart, et al. (2023), the study put forward in Chapter 4 modelled the difference between a draftee's match-to-match performance outcomes in their first season versus their overall career average to decide a discount rate independent of market forces. Unlike the previous studies, this resulted in a different discount rate for each pick in the draft which could be used by decision makers when a trade involves picks both in the current and a year into the future. Within the previous example, the 53rd pick in the current year would be valued at 233 and pick 58 next year would be worth 88. This puts Richmond in front in terms of the exchange, which previously was assumed to be at par. Furthermore, as both parties will not have known the drafting order in the following year (and by extension Richmond's third round pick from 2018), Geelong could use the pick value range for third round picks (i.e., picks 37 to 54) from the discounted year one pick value table produced in Table S5.3, to determine an appropriate consideration based on their own risk appetite.

Whilst pick and player values allows the exchange of such assets in a market environment, it is imperative that teams are able to obtain the best outcomes of such investments by optimising the performance derived from the players they draft. Currently the AFL CBA provides draftees with a two year contract (AFL, 2017). However, clubs have lobbied for this initial contract period to be extended by up to one year, at least for those selected in the first round in order to recoup their investments into the players (Note: since this study, in 2023, the AFL has increased the contract length of first round draftees to three years from 2025). Given the legal precedent set by the NRL, it was important to ensure such policies do not impede a player's economic advancement. Using the survival model proposed in Chapter 3 (Chandrakumaran, 2022), this thesis suggested the use of call options as part of the initial contract negotiation (Chapter 5). Thereby, when a player is initially drafted, the drafting team which wishes to hold said player for an extra year would also purchase a call option at a predetermined compensation package. At the end of two years, the drafting team could either exercise the option to retain the player or refrain from doing so. In summary, both the drafting team and the draftee could hedge themselves economically. Together these three chapters help create an alternative model to value picks, players and future contracts in the AFL draft. Should both the league and teams adopt them, it would potentially minimise any behaviours that could prove to be inefficient and contraire to the spirit of the game whilst allowing clubs to reap the intended benefits of the draft mechanism itself.

9.2 Policy Implications & Practical Outcomes

The primary contribution of this thesis is the new and improved pick value functions that could both value draft picks in the current and future years, together with players active in the league. Whilst this would be an ideal guideline for teams when negotiating trades involving such assets, the new pick value functions should be compared against the current AFL DVI.

As discussed in the literature review, the AFL DVI was introduced as a pricing mechanism so the league could recuperate value from teams exercising both the PAS rules (F/S & C/A). The changes to the bidding system have shifted the strategy behind the draft and its preparation. Previously, the sole purpose of trades relied on acquiring the best talent early on. That is to say, teams would trade up the draft, should they believe a potential player could be contested for by multiple clubs or is more likely to be selected early on due to their potential. Now, the revised system encourages clubs to trade for points and not just for picks as the PAS rules will allow to promote themselves up the draft order as long as they have the points to forgo. Though clubs are constrained in drafting players to fill open spots in their senior list, having more draft picks entering the draft serves the purpose of recruiting players who would not be within a club's reach, should a pure reverse order system be in place. This revised bidding system also has potential loopholes that can be exploited. In order to acquire better players through PAS, teams may trade existing players for later picks, since the concept now is to bank up on picks (the revised DVI to be introduced in 2025 is expected to discourage this (Twomey, 2024a)). Contrary to conventional wisdom (Massey & Thaler, 2013), teams will engage in such behaviour gathering picks from anywhere in the draft as points are more valuable to such teams than picks. On the other hand, teams with no prospective recruits falling under the PAS categories would operate in line with conventional wisdom reliving a number of later picks for early ones. These competing strategies would create arbitrage opportunities within the drafting system as the motivations behind them are governed by two currencies, namely the AFL DVI and a pick value function based on performance as demonstrated in Chapter 6. Besides, this further motivates tanking, as demonstrated in Chapter 8.

Moreover, the choice of compensation as the determinant of value in the AFL's DVI raises further concerns about the validity of the metric. First, AFL draftees aren't strictly amateurs, as players who have played in the league before are allowed to enter the draft, together with those on rookie lists. Inclusion of experienced players complicates the analysis as compensation is usually a reflection of experience (Blass, 1992) and star power (Adler, 1985; Ahlburg & Dworkin, 1991; Berri et al., 2015; Berri et al., 2004), independent to the pick used to recruit them and their productivity gains to the club. Secondly, struggling teams with fewer senior/veteran players would have a higher proportion of their player salary cap available for them to spend on fresh recruits (Kahane, 2001). Hence amateur players recruited to these teams through the draft could have a higher earnings potential after their initial contract period differentiating them against their peers. In addition to this, draftee compensation does not always reflect 'market value', but the negotiating power a club has over a potential recruit and vice versa. The current CBA stipulates all draftees are required to be signed on for two years (to be increased to three years for first round draftees from 2025) and are restricted from moving to any other club during this time (AFL, 2017). This same bargaining agreement stipulates the minimum salary and match fee to be paid for each draftee based on the round of selection. Within the NFL, Massey and Thaler (2013) showed the propensity of teams to overcompensate and retain players selected early on in the draft irrespective of their marginal utility as displayed by the minimal surplus (difference between actual performance and comparable veteran performance at similar compensation levels). Conversely later picks have a much lower retention rate (Stewart et al., 2016). As earlier selections do get more game time and tenure, it further disincentivises against the use of compensation as a determinant of pick value (Chandrakumaran, Stewart, et al., 2023).

Both the pick value functions proposed in Chapters 3 and 4 upheld the conventional norms within sports economic literature of an inverse monotonic relationship (Schuckers, 2011a). Still, the steep decline in value observed in earlier selections with the AFL DVI remained consistent in these models as well. This anomaly could be attributed to the conflicting interests selectors and general managers have in ensuring their recruits meet expectations (or at least appear to do so) in order to validate their sunk investments (Staw & Hoang, 1995), even though their on-field performance did not warrant such actions. This is further supplemented by the findings of Chapters 4, 6 and 7. For example, the upholding of the Coase theorem in Chapter 6 clearly shows that expected performance of players selected through the draft declined monotonically in line with expectations. Yet, the surplus observed amongst early selections, as shown in the appendix of the same chapter (refer to Figure S6.1), remains relatively lower compared to later picks. This reconciles with Massey and Thaler (2013), who observed the over compensation and utilisation of players selected early on in the draft irrespective of their marginal productivity. The discount rate function shown in Chapter 4 also displayed a similar behaviour as the function declined amongst early selections before increasing thereafter (refer to Figure 4.4). This suggests that draftees selected early on were over utilised making their overall improvement negligible in the long run. The findings in Chapter 7 further reaffirmed this assumption where players selected through traded picks had extended tenures not in line with their performance as the sunk investment was much greater when compared to those selected through direct picks endowed on a team.

However, the decline in pick value with the progression of the draft did not correlate proportionally to the AFL DVI but rather tapered off. This questions the effect the draft has on the league in disseminating amateur talent, as there isn't much variation amongst players recruited through the draft. Motomura et al. (2016) questioned the same proposition within the NBA and suggested a team's road to success was determined more by the effectiveness of a team's management and not necessarily the number of good selections in the amateur draft. In lieu of this, should the league incorporate either of the models proposed through this thesis, the value of pick exchanges especially pertaining to PAS rules, would be based on actual outcomes a team is willing to secure through that player. Also, the adoption of these models by teams could enhance their own trade negotiations minimising arbitrage opportunities. By extension, when such trades involve picks from the future, the model presented in Chapter 4 promotes discount rate function to identify the equivalent value of such picks at the present time. Though previous works have addressed this issue on the market's point of view (Massey & Thaler, 2013; Taylor et al., 2018), the function presented through this thesis accounts for the true delay in expected outcomes, which can be used simultaneously with the pick value functions proposed in Chapters 3, 4 and even the AFL DVI.

Finally, from a player compensation perspective, it is essential the movement of players be motivated to maximise their potential earnings. However, as draftees are essentially amateur players, teams should also be given the opportunity to recoup their investments in to training and development. Whilst there has been a consensus that players who remain with the team that initially drafted them would have a longer career (and by extension a higher earning potential, supported by both Chapters 5 and 6), Chapter 5 showed that players selected in the first round of the draft, did have longer career prospects when they move from their original drafting teams. Hence it is ideal to implement the option model proposed in Chapter 5 only for those selected through the first round of the draft, as their earning potential could be inhibited should initial contracts change from two to three years.

9.3 Conclusion

The overall aim of this thesis is to develop an alternative model to value picks, players, and future contracts within the AFL player draft, while analysing the effectiveness of the mechanism itself. To this effect, the first two studies proposed the utilisation of survival models and match-to-match outcomes to determine the value of draft picks, both in the current and future years which can be equated to value active players as well. Understanding the marginal utility of draftees across years in the third study also allowed the validation behind the request of teams to hold amateurs in their initial contract for three years instead of two to capitalise on their investments. Instead of directly increasing contract lengths, the same chapter proposed the adoption of call options which would allow teams to hedge potential increases in salaries and players guarantee reasonable compensation outcomes.

Whilst these studies together provide the alternative model intended from this thesis, the second portion of its aim is to evaluate the draft itself in the absence of the former. Even with deviations in the understanding of pick value, study four suggested player's post draft performance remained in-line with the pick number used to select them, even when the pick itself was exchanged between teams prior to it being exercised. However, their retention in a team's roster differed if the pick used to select them was traded, as teams ride their investments into those picks driven by their misjudgement of value. This was made evident in the behaviour of teams intentionally losing games to obtain priority selections early on in the draft, as shown in Chapter 8. Hence, it is expected that through the adoption of the first part of this work, the league should be able to mitigate the behaviours portrayed in the second half.

9.3.1 Limitations

Whilst this thesis as a whole examined the prevailing inefficiencies in the AFL national player draft and methods to rectify these by proposing an alternative model for pick, player and contract valuation, the variations in methodology adopted throughout resulted in varying conclusions than those observed in the current literature. In modelling performance or survival, the models presented used identification and physical metrics as controls. However, these could be further enhanced by a host of other variables including, but not limited to injury lists, inter-match player positional movements, changes in team management or coaching staff. In addition, it would be better if pre-selection controls, such as the need for positional players, net movement of veterans prior to the draft, and salary cap utilisation are included. These should compensate for any post selection irregularities, providing a wholistic picture. Also, the performance models could use other variables such as player ratings instead of games played and on-field stats used throughout Chapters 3 to 7. Furthermore, as the data used throughout refers to draftees selected between 2003 and 2016, future studies should incorporate up to date data to infer the effects of newer rule changes.

9.3.2 Avenues for Further Research

Though the incorporation of additional metrics and data described in the preceding section would add value to the overall inferences gained by this work, it is equally important to expand on these as well. Prospective avenues for future work could be the analysis of players selected during the pandemic and their diffusion through player rosters thereafter compared to those selected before and after. Furthermore, the CMV metric could also be assessed across different sports and leagues to determine its feasibility and its adaptability. Especially with certain sports which have key positional players, such as quarterbacks in American football and goal keepers in ice hockey and association soccer, a blanket on field statistical predictor could not be applied without a position-based indicator. Based on this notion, the drafts of leagues such as NFL, NHL, MLB and NBA should be evaluated based on the positional subsets as they all contain key positions which might not necessarily translate to the AFL. Hence, any PVC derived for these leagues should be evaluated by position.

Another opportunity would be to evaluate the potential of the draft in achieving the intended outcome of elevating continuously underperforming teams as studies in North American leagues (as shown in the introduction) have shown the ineffectiveness of the draft in achieving the perceived outcome. Though poorly performing teams which receive early selections need not use them to select players with the potential to reverse their fortunes, they could also trade them to obtain veterans to materialise this goal immediately (a recent study in the NFL showed future team outcomes being tied to the final draft currency (which is the post trade draft order) (Lapré, 2024), which is contrary to the idea of the draft itself). This opens the way for future work examining the utilisation of the draft by teams to not only select players but also trade their allocated picks (which can be effectively valued by the outcomes of this thesis) to achieve the same result.

On a decision-making angle, explorations could be undertaken into the behaviour of managers and coaches in negotiating trades involving players and future picks as the latter was only adopted in 2015. Moreover, investigating placeholder trades (i.e., team A trades with team B to only exchange the same to team C) provides ample opportunity in understanding the conscientious process with multiple vested interests. This also allows

PVCs' based on market trade value such as the NFL PVC, to be reassessed based on actual full trades excluding placeholders which might be priced different to the former.

The perverse incentives observed in Chapter 8 could be further expanded to evaluate the effects of the misunderstood DVI similar to the priority pick rule. The behavioural concerns raised earlier could warrant teams to intentionally throw end of season games to build up their DVI wallet prior to the start of the draft. Conversely, the same effect could be examined should the league move to a performance-based pick valuation system as proposed in Chapters 3 and 4 to see if such perverse incentives, if any, exist. It is also important to note that the study of such incentives should not be limited to the draft, but also to other rules within the league such as unbalanced seeding, which can be attributed to both closed leagues such as the AFL and open competitions such as European soccer.

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