

ON THE VALUE OF AFL PLAYER DRAFT PICKS

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Abstract

AFL (Australian Football League) clubs are allocated player selections (“picks”) in the National Draft in reverse order of their final position in the preceding season. Clubs which perform below a certain threshold in a single season are allocated an additional pick, while clubs which meet that threshold in two successive seasons receive a more valuable pick. These somewhat arbitrary thresholds lead to a discontinuous performance / reward relationship, where it is clearly in a club’s best interest to lose certain matches. The natural suspicion and speculation around “tanking” detracts from the integrity of the game, in the eyes of the AFL. However, a recent paper by Borland, Chicu & Macdonald (2009) concludes that there is little evidence of systematic “losing to win” in that league.

A natural and flexible valuation scheme for draft picks is proposed and tested, using extreme value statistics pioneered by Gumbel (1954) in what could be regarded as a variation on Galton (1902)’s Difference Problem. It removes the arbitrary discontinuities while continuing to support competitive equalisation via higher picks for genuinely struggling clubs. This draft pick method does not enforce a constant order to be followed in every round. As a corollary, the scheme suggests a method for clubs to value their picks when developing trading strategies. It could also furnish the AFL with an alternative means of compensating clubs for the loss of key players to start-up teams, and penalising clubs for transgressions.

While this scheme has direct applicability to the AFL, it is easily portable to other sports’ player drafts, such as the NFL, MLB and NBA.

Keywords: Australian Rules Football, AFL, Player Draft, Extreme Value Theory, Galton’s Difference Problem

1. INTRODUCTION

The Australian Football League (AFL)'s annual National Draft is the only way for existing clubs to add players to their squads¹, and is therefore crucially important to their prospects. In common with many other sports, as part of its competition equalisation policy the AFL allocates draft picks in order of reversed final position on the ladder (AFL Development, 2010). More controversially (see e.g. Sheahan (2009)), clubs are allocated "priority" picks if they are considered to be direly uncompetitive. A team which fails to win more than four matches is given an extra pick between the first and second rounds of the draft, while a team falling below this threshold in two consecutive seasons has its priority pick upgraded to above the first round. In this way Melbourne Football Club received both of the first two draft picks in the 2009 draft after finishing last with exactly four wins in the second of its dire seasons. Certainly the reward for Melbourne losing just its last game was immense: access to the two best players in the country, rather than one.

With the addition of new clubs over the next two years, the AFL has proposed a formula to compensate existing clubs for the loss of star players. Wilson (2010) suggests that for the very best players, the AFL may provide two first-round picks instead of one, with the club able to choose which year it exercises the extra picks, but only after its existing first-round pick (the position of which will vary from year to year). For a club in this situation, there is a great deal riding on the AFL's decision, and the quantum of compensation is rather large – they cannot have 1.5 first-round picks, for instance.

In this paper I develop a valuation system for draft picks and advise how the arbitrary thresholds in the system might be abolished without losing the ability to help truly uncompetitive teams.

AFL Draft Research

Borland, Chicu & Macdonald (2009) examined the teams faced by these perverse incentives for deliberately losing (also known as "tanking") and concluded that there is no significant change in behaviour. A dreadful season can lead to loss of sponsors and members, and fewer lucrative TV slots when the fixture is drawn up. Rielly (2009) reported on commissioned research by Mitchell et al (2009) that found good correlation between draft order and subsequent player performance for the first round

only, with very weak correlation after pick number 16. Bedford & Schembri (2006) proposed a system where clubs not in contention for finals are rewarded for winning formally unimportant matches with an improved draft position.

Other Leagues' Draft Research

Professional US leagues such as the NFL, NBA and MLB have similar annual drafts. Burger & Walters (2009) point out that there is high risk and a lot of money at stake: only 8% of players picked in the first ten rounds of the MLB draft become established Major League players. Barzilai (2007) thoroughly analyses the empirical value of NBA Draft pick players. Berri & Simmons (2009) give an example of teams not using their choices wisely, with only a weak correlation between NFL amateur draft order and performance. Massey & Thaler (2005) state that NFL clubs overvalue the right to choose, and pay too much for the first pick in the draft.

The NFL Draft appears to receive the most attention, likely due to a famous "Draft Value Chart" developed around 1990 (Trotter, 2007) under Dallas Cowboys head coach Jimmy Johnson, anecdotally (Crowe, 2009) with help from mathematicians although the exact derivation is unknown. The chart gives a rule-of-thumb value that clubs should place on their draft picks when they are considering trading, so for instance the 1st pick is worth 3,000 points, 2nd pick 2,600, 16th pick 1,000, etc., down to the 224th pick worth 2 points. Recently there have been a number of comprehensive analyses assessing and adjusting this chart (e.g. Stuart (2008), Patterson (2009), Vance (2009)), based on performance ratings of the players picked at those positions, but none presenting an underlying theoretical model.

Extreme Value Theory

Francis Galton (1902) asked the question: if a competition has a £100 pool and there will be prizes for first and second, "How should the £100 be most suitably divided between the two?" His answer of roughly £75 : £25 is based on the expected value of the "excess merit" of someone in those positions, compared to the third-place competitor. Subsequent extensions to n prize-winners in large pools of competitors grew into a branch of Extreme Value Statistics, pioneered by Gumbel (1935) and Fisher & Tippett (1928).

I draw a parallel to the "competition" between potential draftees. The potential talent pool consists of young men with diverse aptitude for football. In a demographic sense, it is reasonable that an aptitude score for the population cohort of 18-year-old Australian men should be approximately normally

¹ Player trading is only permitted within the framework of the Draft, and usually in exchange for draft picks

distributed², like many other broad-based attributes. The players drafted would then form one extreme tail of that distribution, assuming that clubs can make an efficient assessment of that aptitude. I propose a system in which the k^{th} draft pick has a value proportional to the k^{th} order statistic of a suitably large normal population. This paper shows the necessary calibrations and consequences.

2. METHODS

Galton's method of allocating prizes considered firstly a population of $n=10$. His simple assumption was that the most probable values of merit Θ for the ten competitors correspond to equidistant values of the cumulative distribution function (CDF), namely 0.05, 0.15, 0.25, 0.35, 0.45, 0.55, 0.65, 0.75, 0.85, 0.95. By looking up numerical probability integral tables, he discovered that the ratio of first's advantage over third compared to second's advantage over third was about 72.8:27.2. As he increased n , the ratio approached a limit of about 75.4:24.6. Therefore his proposal was that the most appropriate prize for first is about 75% of the pool.

Estimates for Extremal Values

ABS (2009) shows that at September 2009 there are approximately 772,070 males between the ages of 15-19 in Australia. The eligible demographic passing through the annual AFL Draft window is approximately one-fifth of that, indicating an appropriate $n = 155,000$. While men can nominate for multiple drafts, in theory they should be drafted when first eligible as their inherent aptitude is considered to be constant.

The modal value of the k^{th} extremal of a normal distribution is (Gumbel, 1954, equation (3.32)):

$$u_k = \Phi^{-1}(k/(n+1)) \quad (1)$$

where Φ is the CDF of the normal distribution with PDF ϕ . The mean is slightly higher (ibid.):

$$\mu_k = u_k + (\log k - S_k + \gamma)/n\phi(u_k) \quad (2)$$

where $\gamma \approx 0.577216$ is the Euler-Mascheroni constant and

$$S_k = \sum_{j=1}^{k-1} \frac{1}{j} \quad (3)$$

is the k^{th} harmonic number. Blom (1958) generalised the different equidistant formulas of Galton and Gumbel into an approximant for the mean:

$$m_k = \Phi^{-1}\left(\frac{k - \alpha}{n - 2\alpha + 1}\right) \quad (4)$$

and proposed $\alpha = 3/8$ as a rule-of-thumb constant between Galton's $\alpha = 1/2$ and Gumbel's modal

$\alpha = 0$, although Harter (1961) pointed out that α actually varies with n .

With such a large n , it is worth considering whether the asymptotic ($n \rightarrow \infty$) form³ is appropriate. Ideally, there should not be a dependency on the ABS's latest demographic trends each year in order to calibrate the draft. Fisher & Tippett (1928) point out that the tendency toward asymptotic form is exceedingly slow in the normal case (David & Nagaraja, 2003), while Dronkers (1958) proposes that it should only be used when the extremal index $k \ll \sqrt{n}$.

Cramér (1946) equation (28.6.16) gives the asymptotic formula for the mean of the k^{th} extremal:

$$\sqrt{2 \log n} - \frac{\log \log n + \log 4\pi + 2(S_k - \gamma)}{2\sqrt{2 \log n}} \quad (5)$$

The choice of formula to measure the value of each draft pick makes a significant difference to the first few picks, but little difference to the rest. In the table below, the difference between pick one and pick two is compared to the difference between pick two and pick ten.

Method of Valuation	$\frac{m_1 - m_2}{m_2 - m_{10}}$
Galton ($\alpha = 0.5$)	0.55
Mode ($\alpha = 0$)	0.41
Mean ($n = 155,000$)	0.63
Asymptotic Mean ($n \rightarrow \infty$)	0.70

Table 1: Relative Value of First Pick by Method

Under the assumptions outlined, the average aptitude or merit of the best young players in the country should follow the "Mean" valuation method. Consider however the assumption that clubs have perfect skills in assessing that hidden variable. If clubs are not efficient assessors, the impact of the error will fall most heavily on the clubs with the early picks. In particular, the club with the first pick can only obtain full value by choosing the best player in the pool. The club with the second pick has a non-zero chance of doing better than its allocation, if the first club makes an error of choice, but could also make an error and choose a player worse than the second-best. Perhaps this effect is evident in the findings discussed in the introduction, where the first pick is empirically overvalued.

I therefore propose to use the modal (or most likely) value in the valuation method. This keeps the

² Galton makes the same proposal for merit

³ The characteristic distribution of the extremal is the Gumbel Distribution with CDF = $\exp\left(e^{-\frac{x-\mu}{\sigma}}\right)$

dependency on n , but the valuation ratios do not vary materially from year to year.

The Worthless Pick

Galton decided that in the simplest version of his question, there should only be two prizes. Every competitor from third onwards was treated the same. Having decided on the shape of the valuation method, I also need to set the zero. Every potential player below a certain level of aptitude is the same, as far as the clubs are concerned. This is essentially an empirical judgement – when do the clubs decide their next pick is worthless?

In the AFL National Draft, clubs may take between four and eight players. In 2009, both Melbourne and Fremantle elected not to use their early fifth-round picks (#66 and #68 respectively), effectively declaring them valueless. The last pick used was #95, compared to #83 in 2008 and #75 in 2007. Geelong traded away two unwanted players (Steven King and Charlie Gardiner) in 2007 for pick #90, which they did not use. For the purposes of constructing the model, I will draw the line after six rounds, i.e., pick #97. The exact zero point does not have much of an effect on the valuation scheme, because the difference between subsequent picks near the zero is quite small.

At the other end of the scale, I will conform to the NFL convention and arbitrarily value the first pick at 3,000 “Draft Points”. Therefore the linear transformation to pick values v_k ($0 < k < 97$) is

$$v_k = 3000 \cdot \frac{m_k - m_{97}}{m_1 - m_{97}} \quad (6)$$

Allocating Draft Picks to Clubs

Based on their season performance, clubs are allocated a certain number of Draft Points. The simplest version of the model replicates the current draft, with club c (numbered from 1st on the ladder to 16th) receiving Draft Points $P_{c,1}$ according to:

$$P_{c,1} = \sum_{k=17-c, 33-c, 49-c, \dots}^{97-c} v_k \quad (7)$$

The second index indicates the number of Draft Points club c has prior to pick i . To determine the draft order after the season, the following algorithm is run for each pick i :

1. Find the club t with the most remaining Draft Points, i.e., $t : P_{t,i} = \max_c \{P_{c,i}\}$
2. Club t owns pick i and has v_i Draft Points removed from its total: $P_{t,i+1} = P_{t,i} - v_i$

In this simple model, each club receives a pick in reverse ladder order for every round.

Note that Draft Points are positive real numbers.

Measuring Need

Draft Points could also be allocated in a completely different way, for instance through a formula which rates a team for its ladder position, number of wins, and/or percentage (points for / points against). Often there are a number of clubs in the middle of the ladder with similar win-loss records. In 2009, Sydney won just one fewer match than Hawthorn and had a better percentage, yet received picks 6, 22, 38, ... compared to 9, 25, 41, ... because they finished three rungs lower on the ladder. On the Draft Point scale, Sydney were allocated 4,435 points to Hawthorn’s 3,938 – 12.6% more – despite the difference in quality between the two being virtually undetectable. A formula which rated the middling teams closer together would see a more balanced allocation of draft picks.

The philosophy of the draft is to adequately support struggling clubs, so that they can become average clubs. In the past, the reward for finishing last in consecutive seasons has tended to overcompensate the dire clubs and allowed them to compete at the top of the ladder within 6-8 years (Mitchell et al, 2009). It should not unduly punish the premier – the current allocation of the last pick in each round would remain the standard.

A possible formula to achieve these ends is as follows:

- The eight finalists are allocated Draft Points as per (7)
- Non-finalists are given an initial “Need Rating” (8) based on their number of wins and percentage. Points for-versus-against percentage is considered a safe indicator, as teams do not deliberately set out to be thrashed. It is demoralising for the players and supporters, and a percentage below 70% points to dire need
- The Need Rating is topped up with a fraction of the club’s previous season Need Rating, from 7.5% (9th) to 60% (16th). Clubs which made the finals in the previous season have no carry-over rating
- The Need Rating is linearly transformed into Draft Points (9) using constants dependent on (6)

$$\text{Need Rating } NR_c = 94 - \frac{PC}{2} - PP \quad (8)$$

where PC is the club’s percentage and PP is their premiership points (four for a win and two for a draw). 94 is chosen so that a team with the competition average 44 points and 100% is not considered in need. If NR_c is calculated at less than zero, it will be taken to be zero.

$$P_{c,1} = 4003 + 6710 \cdot \frac{NR_c}{\sum_j NR_j} \quad (9)$$

3. RESULTS

Table 2 displays the complete set of Draft Points for a 16-club, six-round draft.

Pick	Points	Pick	Points	Pick	Points	Pick	Points
1	3,000	25	977	49	504	73	213
2	2,593	26	950	50	489	74	203
3	2,348	27	924	51	475	75	193
4	2,171	28	899	52	461	76	183
5	2,032	29	874	53	447	77	173
6	1,918	30	851	54	434	78	164
7	1,820	31	828	55	420	79	154
8	1,734	32	806	56	407	80	145
9	1,658	33	784	57	394	81	135
10	1,590	34	763	58	382	82	126
11	1,528	35	743	59	369	83	117
12	1,471	36	723	60	357	84	108
13	1,418	37	704	61	345	85	99
14	1,369	38	685	62	333	86	91
15	1,323	39	667	63	321	87	82
16	1,280	40	649	64	310	88	73
17	1,239	41	631	65	298	89	65
18	1,201	42	614	66	287	90	56
19	1,164	43	597	67	276	91	48
20	1,129	44	581	68	265	92	40
21	1,096	45	565	69	254	93	32
22	1,065	46	549	70	244	94	24
23	1,034	47	534	71	233	95	16
24	1,005	48	518	72	223	96	8

Table 2: Value of the k^{th} Draft Pick

The only publicly available comparison for this theoretical model is the NFL Draft Value Chart:

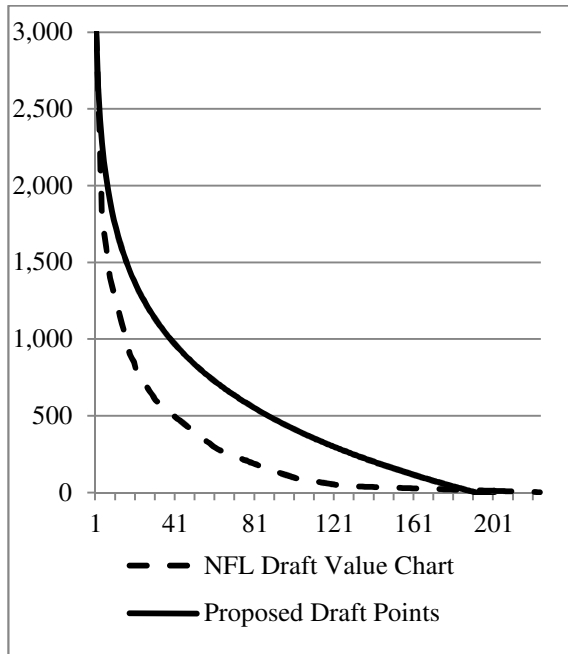


Figure 1: The NFL Draft Value Chart (Crowe, 2009) compared to the proposed valuation scheme.

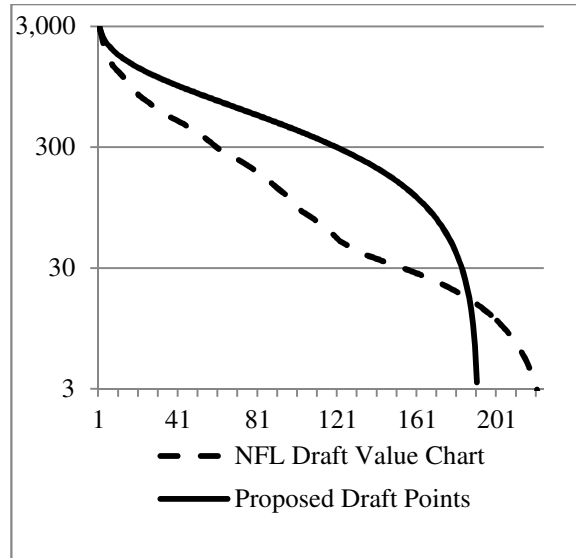


Figure 2: The NFL Draft Value Chart compared to the proposed valuation scheme on a logarithmic scale.

The extreme-value model clearly does not fit the published NFL charts, even after taking the USA's larger population into account. The mid-range choices on the chart are substantially undervalued in comparison. It appears from the log-scale Figure 2 that the NFL chart may have been drawn from a simple logarithm then smoothed from about pick 130 to asymptotically approach zero. Potentially there is merit in this smoothing, as late picks have some residual value due to the rare good player who is still uncovered at that late stage, but most will be close to the minimum league standard.

The divergence between the two curves is similar to that seen by Stuart (2008), who used empirical career data to rate the actual picks from 1970 to 1999.

2009 Season Example

Table 3 compares the number of Draft Points clubs would receive under various scenarios. The second column is a regular ladder without any priority picks, the third column is how the points were allocated after Melbourne received the priority pick, and the fourth column shows what clubs would have received under the formula of the previous section.

Club	Regular	2009 Draft	Proposed
Geelong	3066	2961	3066
St Kilda	3176	3066	3176
W Bulldogs	3289	3176	3289
Collingwood	3407	3289	3407
Adelaide	3530	3407	3530
Brisbane	3659	3530	3659
Carlton	3795	3659	3795
Essendon	3938	3795	3938

Hawthorn	4091	3938	4324
P Adelaide	4256	4091	4446
West Coast	4435	4256	4687
Sydney	4633	4435	4422
North Melb	4858	4633	4603
Fremantle	5123	4858	5132
Richmond	5459	5123	4978
Melbourne	5961	8459	6225

Table 3: Draft Points comparison

The extraordinary boost received by Melbourne for not winning its last game of 2009 is evident here: an extra 2,498 Draft Points. There are several differences in the proposed scheme, with Fremantle and West Coast (14th and 15th in 2008) carrying some Need Rating over to 2009. Melbourne would have received 6475 Draft Points in 2008, before winning an extra game with a substantially superior percentage in 2009.

Figure 3 shows how the picks are allocated in a traditional draft (left) compared to one derived from the points of the last column of Table 3:

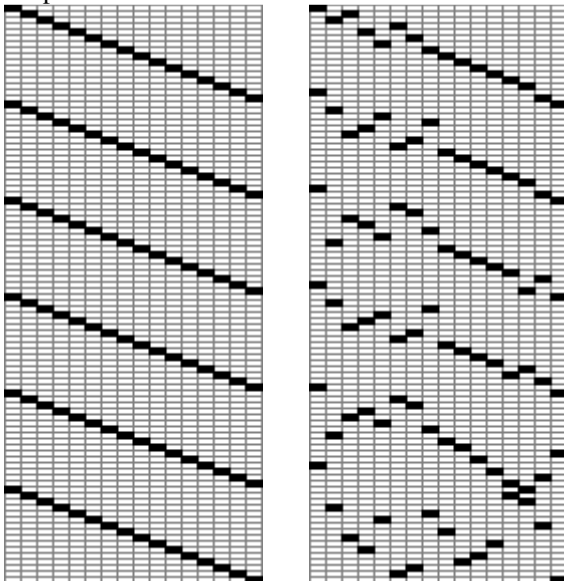


Figure 3: A regular draft (left) compared with one run according to the proposed valuation scheme. Columns are the clubs in reverse ladder order; each row is a draft pick from top to bottom.

Melbourne receives picks #1, #15, #31, #47, #64 and #77 in the proposed scheme. Its second pick pre-empted ($c=2$) St Kilda's first pick, which becomes #16. As compensation, St Kilda receives its third pick ahead of Western Bulldogs ($c=3$). Note also that although Fremantle received pick #2, the subtraction of that pick's value means its next pick is not until #22 (6th in the "round"). By the time the draft gets to the last round, the order is unrecognisable.

4. DISCUSSION

Applications of the Draft Point valuation scheme are numerous. They provide trade utility, not being grossly quantised like players or full picks. Additionally, clubs that lose a star player to a new franchise could be appropriately reimbursed with Draft Points by making the existing discrete compensation formula continuous.

Clubs which transgress against salary cap regulations or other AFL rules could be penalised in Draft Points, not necessarily completely excluded from the draft.

The AFL National Draft is followed by a Rookie Draft and Pre-season Draft. While these have not been mentioned in the methodology, they should be brought into the same system. Mitchell et al (2009) assert that players selected early in the Rookie Draft can have an impact similar to a second-round National Draft pick.

We may also judge past and future trades and player selections against the measuring stick of Draft Points. As an example, during 2009 Trade Week complex negotiations between Hawthorn, Essendon and Port Adelaide involving star players Shaun Burgoyne and Mark Williams had reached an impasse because the teams could not agree on the number of the draft pick. Geelong entered the discussions and provided an acceptable draft pick in exchange for a number of lower selections. Geelong's contribution can be accounted for thus:

Transaction	Draft Points
Sell pick #33	-784
Sell pick #97	-0 (not used)
Receive pick #40	+649
Receive pick #42	+614
Receive pick #56	+407
Net Gain	+886

Table 4: Geelong's Pick Trading in 2009

Geelong made an extraordinary 886 point gain on the trade, the equivalent of an extra #29 pick. One might think they had a mathematician in the negotiations!

5. CONCLUSIONS

This paper has presented a mathematical basis for valuing selections in a sports league draft. Potentially there are other applications where allocations of choice are made, for instance in game theory. Calibration of the model for other sporting leagues should be relatively easy and robust.

Mitchell et al (2009) have examined AFL performance data relative to draft position and

identified two disjoint trends, for high and low picks. It would be interesting to re-examine their data for fit against this model.

A possible extension would be to include a stochastic model of the clubs' ability to choose the next most talented player in the pool. Another candidate for adjusting the model would consider that many draftees never play, despite having an aptitude very close to AFL standard, so their actual value to the club is lower than the extreme-value model suggests. These may smooth the characteristic curve in a way similar to the NFL Draft Value Chart. It is hoped that mathematicians can play our part in removing the taint of tanking from the AFL, if only to give journalists something more edifying to write about.

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