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An Alternative to the NFL Draft Pick Value Chart Based upon Player Performance

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Abstract

In this paper, we consider the National Football League Pick Value Chart and propose an alternative. The current Pick Value Chart was created approximately 20 years ago and has been used since to determine the value of draft selections for trading of draft selections. For this paper, we analyze the first 255 draft selections for the years 1991 to 2001. As part of our analysis, we consider four non-position dependent metrics to measure and model player performance at each of the first 255 draft selections. We perform a nonparametric regression of each performance metric onto player's selections. A comparison is then made between each fitted line and the Pick Value Chart. Having considered these comparisons, we propose an alternative Pick Value Chart.

KEYWORDS: National Football League, draft, nonparametric regression, performance, football, LOESS

1 Introduction

The National Football League (NFL) is a professional league of American Football based in the United States. Each year the NFL allocates eligible players among its teams via a draft. In each round, each of the 32 teams selects a single player. The order of team selections is based upon the previous year's performance. Teams can trade their draft selections for players or for future draft selections or for a combination of these two. Additionally, teams can be given draft picks at the end of rounds as compensation for losing current players to free agency. In 2010, the NFL draft had seven rounds and a total of 255 players were selected.

Sometime around 1990, the Pick Value Chart (PVC), or The Chart (Massey and Thaler, 2010) , was introduced as a way of assigning value to each draft selection. Figure 1 plots the value of the PVC against a players selection. (A complete version of the PVC is found in Table 5 at the end of this article.) This chart allowed teams to have a single currency for determining if a trade of draft picks provided equivalent value. McGuire (2010) states the that original PVC was developed by Jimmy Johnson who coached the Dallas Cowboys from 1989 to 1999. Johnson supposedly used historical trade data to devise the PVC (Smith, 2007) . Recently, Massey and Thaler (2010) evaluated the PVC on the basis of the value of subsequent contracts awarded to players to determine that the PVC overvalues early draft selections particularly those in the beginning of the first round of selections. Berry (2001) looked at comparing success rates for first round picks across a variety of sports where success was defined by making an All-Star team. Others who have looked at creating updated versions of the PVC include Stuart (2008) and Maier (2010) though these versions primarily involved minor modifications to the current PVC. In this paper we show that the PVC is not reflective of player performance and we provide an alternative chart to the PVC based on past player performance. The remainder of this paper is organized in the following way. Section 2 discussion the notation and variables that we will use here and gives univariate summaries of our performance metrics. Section 3 compared the PVC to other performance metrics. We create an alternative version of the PVC and discuss it in Section 4. A summary of the work here as well as a discussion are summarized in Section 5. An appendix that contains a copy of the PVC as well as our alternative is found in Section 6.

2 Data

The data that we will use to evaluate the PVC comes from `Pro-Football-Reference.com` Pro Football Reference (2010) . We are using every player selected among the first 255 players in the NFL drafts that occurred

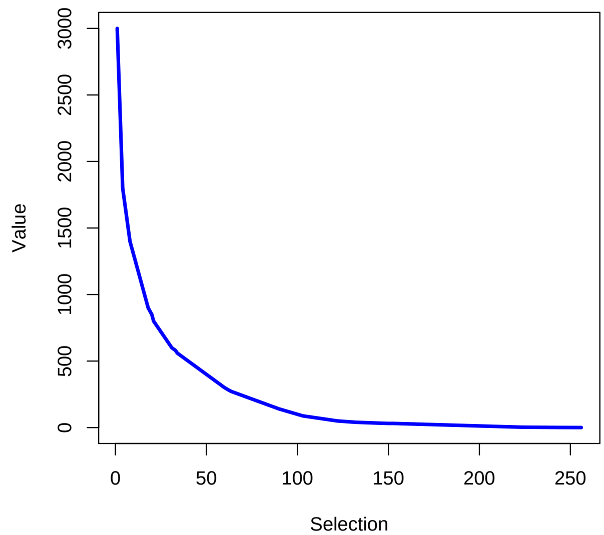

Figure 1: Pick Value Chart

from 1991 to 2001. Selection of these particular years was based upon a tradeoff among the need to have recent selections to reflect current trends in players, the need for sufficient samples sizes at each selection and the potential bias from including large numbers of players who are still active. Since we are going to predict draft value, we used the length of the 2010 NFL draft, 255 selections, as our target length. Along with the name of the player selected we have several variables for each player including their selection number — the order in a given draft that they were selected, the team that selected the player, and the position of the player. Further we have a set of performance measures for each player through the end of the 2009 NFL season. The performance measures that we have for every player are the number of games in which they appeared (G), the number of games that they started (GS), the Career Approximate Value (CAV) and the number of Pro Bowl (PB) appearances they had. CAV is a player metric devised by Drinen (2008) and is calculated by `Pro-Football-Reference.com` and is a method for comparing the value of players over their careers. Number of Pro Bowl appearances is the number of times that a particular player has been selected to the end of season all-star game. Additionally, it is possible to obtain performance measures that are position specific. In this paper we will not discuss these position specific metrics for two reasons. First, for a measure to be appropriate for use in assessing trade value it must assess value across positions. Second, the typical value derived from these measures tends to follow a similar pattern to those given by the metrics described above.

Table 1: Player Counts By Position

Position	DB	DL	K	LB	OL	QB	RB	TE	WR
Counts	507	446	42	365	438	120	281	162	332

DB represents a defensive back, DL a defensive lineman, K a kicker, LB a linebacker, OL an offensive lineman, QB a quarterback, RB a running back, TE a tight end and WR a wide receiver.

Table 2: Player Performance Summary Statistics

Metric	25^{th} percentile	50^{th} percentile	75^{th} percentile	Mean	Standard Deviation
Games Played (G)	24.0	66.5	119.0	75.3	59.0
Games Started (GS)	0.0	9.0	62.0	36.5	50.2
CAV	2.0	10.5	33.0	20.7	23.6
Pro Bowls (PB)	0.0	0.0	0.0	0.3	1.2

Among the $n = 2693$ players in our sample, Table 1 has a breakdown of the number of players selected by position. Kickers (K) includes both punters and placekickers. Summaries including means and standard deviations for player performance metrics are given in Table 2. Noteworthy in that table is that over 25%, 33.3%, of all drafted players never start a game and at least 75% of all players never play in a Pro Bowl. 9.3%, or 213, of the players in this sample were still active during the 2009 NFL season. As a consequence we will use robust measures of player performance that are less dependent on these players in the tails of our distributions.

3 Player Performance Evaluation

In this section, we will consider how our performance metrics on NFL players compare to the PVC. We begin by considering Games Played (G). Figure 2 plots G against the selection for each player in our sample. We fit a non-parametric regression line to these data and this is also plotted in Figure 2. This regression line was fit using the `loess` function in the statistical software R (R Development Core Team, 2007) with a span of 0.5. A locally weighted scatterplot smoothing or

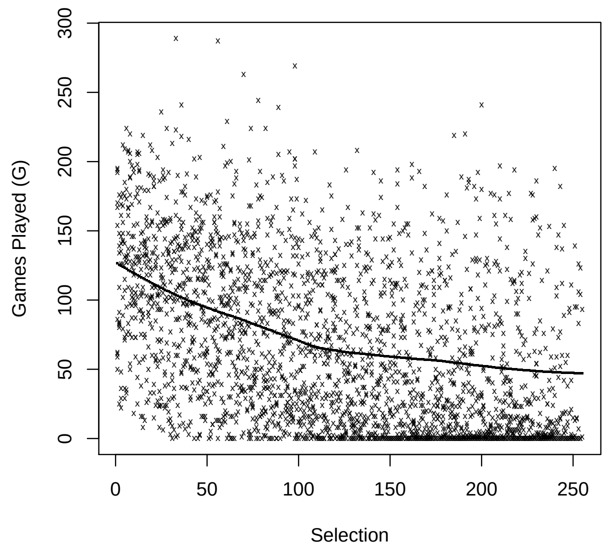

Figure 2: Games Played (G) by Selection with LOESS regression line

LOESS is fit at each value of the predictor by taking a locally polynomial — in this case quadratic — weighted fit of response values where the weights depend upon the cubic distance from the value. As we would expect, that fit line is a monotonically decreasing one. We note that the decline in G on this graph as the selection number increases is more linear than was the case for the PVC (Figure 1). The non-parametric fit here seems to be composed of two nearly linear line segments. The first line segment goes from selection 1 to selection 110. The second is not as steep as the first and goes from selection 110 to selection 255.

We next consider the response GS by selection. The relationship between GS and selection can be seen in Figure 3. That relationship is noticeably non-linear. As was the case for games played, the relationship is monotonically decreasing though the decrease is more exponential in shape. Though this relationship is more similar to the PVC, the rate of decrease is much slower. The fitted line here reflects the average decrease in games started as the selection number increases. The number of players who did not start a game is higher, 896, than to the number of players that never appeared in a game, 398. This accounts for the intensity of values along the x-axis in Figure 3.

CAV is the next performance metric that we consider. As mentioned above, this measure was created by Drinen (2008) as a metric of player value to allow the comparison of players across positions. We will use it for similar purposes here.

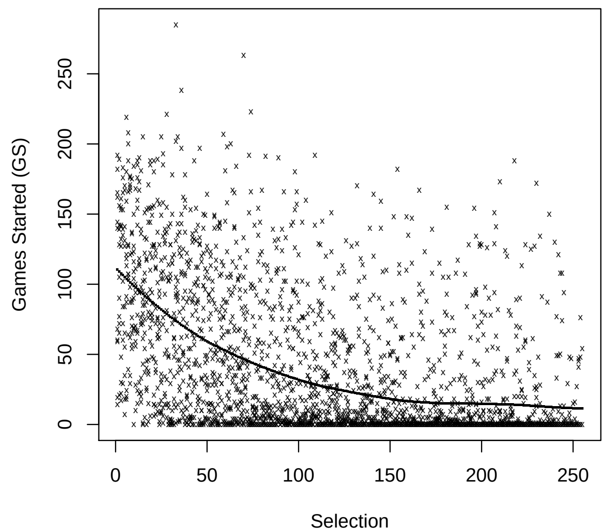

Figure 3: Games Started (GS) by Selection with LOESS regression line

Figure 4 shows the relationship between CAV and selection number along with a LOESS regression line. The overall form of this line is very similar to that of the LOESS regression line for GS. Both have a exponential rate of decline and both are monotonic. A comparison of the two curves normalized so that their sums are equal shows that the difference between the two is never more than 10% and only exceeds 8% after the 230^{th} selection. The correlation between the LOESS regressions for GS and CAV is 0.995.

The final measure of player performance that we will consider is the number of Pro Bowl Appearances. Figure 5 gives a scatterplot of PB versus Selection for all of the players in our sample. The relationship displayed there is dominated by the number of players, 2385 out of 2693 in our sample, who never appeared in a Pro Bowl during their careers. The LOESS line that is given in Figure 5 is fairly linear and includes some non-monotonic behavior between selections 117 and 160. We attribute this anomaly to three players who had values of PB of more than 5 in that range of selections. We suspect that the typical relationship between PB's and Selection is monotonically decreasing. A further analysis of early NFL drafts suggests a monotonic relationship.

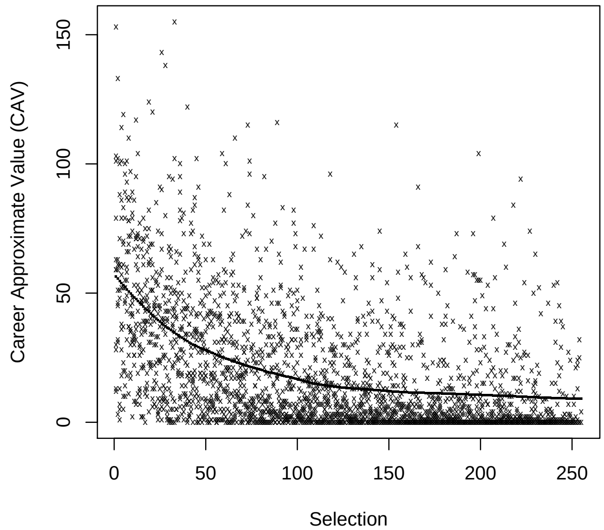

Figure 4: Career Approximate Value (CAV) by Selection with LOESS regression line

4 An Alternative to the PVC

In the previous section we looked at four different measures of NFL player's career performance. All four of those metrics are useful metrics for assessing the value of a player over their career. What is clear from the above analyses is that based upon the LOESS regressions none of these metrics matches the PVC in the way that they value players. All four of the metric that we considered value players in different ways. Games played (G) values players who contribute to a team in some manner. Games started (GS) values players who are the best at their position on their team. Career Approximate Value (CAV) is an measure that assigns to a player a portion of his team's value for each year and then uses a weighted sum over his career. Pro Bowl appearances (PB) rewards a player for being among the best players at their position for a given year. Figure 6 has a comparison of the LOESS regressions for each of these metrics versus the PVC taking the natural logarithm of each value for each selection. The values there are normalized so that the total value for all metrics is the same as the total value of the PVC. Table 3 has the normalized fitted values for each of these lines at several selections. Relative to the other metrics, the current PVC overvalues early draft selections particularly the first 50 selections and undervalues selections from 150 to 255. From that graph we can see that the PVC

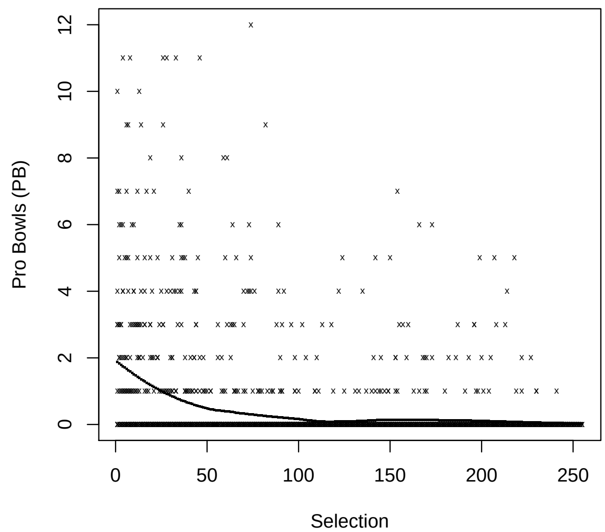

Figure 5: Pro Bowl Appearances (PB) by Selection with LOESS regression line

roughly mirrors the LOESS value of PB over the first approximately 120 selections, though the PVC does exceed the fit PB by 0.8 on the log scale for the first selection. In this graph the non-monotonicity of the PB fitted line is apparent. Additionally, based upon Figure 6 all of the other metric diverge notably from the PVC after the 100^{th} selection which suggests that the PVC undervalues players taken after this selection relative to these other measures. As mentioned above, GS and CAV have very similar LOESS lines while G has a line that values later selections higher than any of the other methods.

Keeping all of this in mind, we propose to use LOESS predicted GS as the metric for our alternative PVC (APVC). We do so for several reasons. First, we concur with Massey and Thaler (2010) that the current PVC overrates early draft selections. Second, our analysis finds that the PVC underrates late draft selections relative to all of our other measures of player performance. Third, we find that GS is a better overall metric than G or PB for evaluating the worth of a player even allowing for a monotonic version of a fitted PB line. Fourth, we choose GS over CAV since it is a simpler metric and, therefore, is easier to calculate and to predict. Our proposed APVC is found in Table 4. To make the APVC somewhat comparable in value to the PVC, we inflated the value of the first selection to 1000 and inflated all of the other selections the same amount. (The inflation factor here is 6.71.) We do note that the relative values of the 1^{st} and 255^{th} selections are a

Table 3: Normalized Fitted Value of Performance Metrics for Specific Selections

Selection	1	50	100	150	200	250
VPC	3000.0	400.0	100.0	31.4	12.4	0.7
G	420.3	314.3	234.7	196.6	174.4	157.3
GS	739.6	397.9	214.1	122.3	99.5	77.9
CAV	704.8	348.7	208.1	150.7	132.6	114.6
PB	1363.5	350.8	117.8	101.0	79.0	26.4

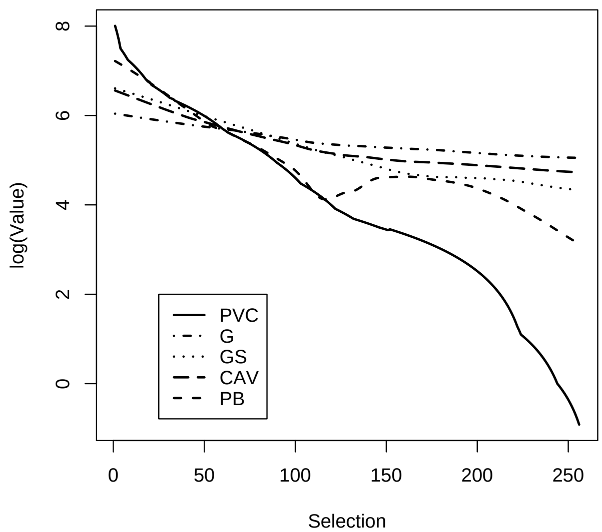

Figure 6: Comparison of PVC and alternative player value metrics

factor of approximately 10 for the APVC while they are 7500 for the VPC. There is an additional benefit to using an APVC based upon games started which is that the AVPC provides a way to evaluate how individual draft selections perform relative to what is expected in a straightforward manner.

Table 4: Proposed Alternative NFL Pick Value Chart

Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value
1	1000	33	670	65	449	97	301	129	209	161	149	193	135	225	123
2	988	34	661	66	443	98	297	130	206	162	148	194	135	226	122
3	976	35	653	67	438	99	293	131	204	163	147	195	135	227	121
4	964	36	644	68	433	100	289	132	202	164	146	196	135	228	121
5	953	37	636	69	427	101	286	133	200	165	145	197	135	229	120
6	941	38	628	70	422	102	282	134	197	166	145	198	135	230	119
7	930	39	620	71	417	103	279	135	195	167	144	199	135	231	118
8	918	40	612	72	412	104	275	136	193	168	143	200	134	232	117
9	907	41	604	73	407	105	272	137	191	169	143	201	134	233	117
10	896	42	597	74	403	106	269	138	189	170	142	202	134	234	116
11	885	43	589	75	398	107	265	139	187	171	141	203	134	235	115
12	874	44	581	76	393	108	262	140	185	172	141	204	134	236	114
13	863	45	574	77	388	109	259	141	183	173	140	205	133	237	113
14	853	46	566	78	383	110	256	142	181	174	140	206	133	238	113
15	842	47	559	79	378	111	253	143	179	175	139	207	132	239	112
16	832	48	552	80	374	112	250	144	177	176	138	208	132	240	111
17	821	49	545	81	369	113	247	145	175	177	138	209	131	241	111
18	811	50	538	82	364	114	244	146	173	178	138	210	131	242	110
19	801	51	531	83	360	115	241	147	171	179	138	211	131	243	109
20	791	52	525	84	355	116	239	148	169	180	137	212	130	244	109
21	781	53	518	85	351	117	236	149	167	181	137	213	130	245	108
22	771	54	512	86	346	118	234	150	165	182	137	214	130	246	107
23	761	55	506	87	342	119	232	151	164	183	137	215	129	247	107
24	752	56	500	88	337	120	229	152	162	184	137	216	129	248	106
25	742	57	494	89	333	121	227	153	160	185	137	217	128	249	106
26	733	58	489	90	329	122	225	154	158	186	137	218	128	250	105
27	724	59	483	91	325	123	223	155	157	187	137	219	127	251	105
28	714	60	477	92	321	124	220	156	155	188	137	220	127	252	104
29	705	61	471	93	316	125	218	157	154	189	137	221	126	253	104
30	696	62	466	94	312	126	216	158	152	190	136	222	125	254	103
31	687	63	460	95	308	127	213	159	151	191	136	223	125	255	103
32	679	64	454	96	305	128	211	160	150	192	136	224	124		

5 Discussion

In this paper, we have evaluated the current NFL Pick Value Chart (PVC). We have analyzed other performance metrics for evaluating the value of a draft selection. These metric included the number of games in which a player appears, the number of games that a player starts, the number of times they are chosen for the Pro Bowl and their Career Approximate Value (CAV). Our analysis agrees with previous work done by Massey and Thaler (2010) and finds that the current PVC overvalues early draft selections. Thus, we have proposed an alternative PVC or APVC that is based upon an non-parametric regression of games started onto draft selection. This APVC can be found in Table 4. This alternative provides a new method for determining the value of a draft selection. One future direction for this work is to develop methodology for considering which teams drafted best during the time period covered by our sample.

There are certainly other factors that go into how a team might value a particular section besides the factors that we have considered here. Foremost among these is certainly the needs that a team might have at a particular position. If such a need exists and a team feels that a particular player can fulfill such a need, then they might attach additional value to a selection. Additionally, a player might provide revenue to a team through additional ticket or merchandise sales. We have not considered player salaries as part of this analysis but they certainly do impact player selections. Early selections are paid substantially more than later selections. For the 2010 draft, the first selection, Sam Bradford, was paid an annual rate of approximately \$$13,000,000$ and the 255^{th} player selected, Josh Hull, was paid an annual rate of approximately \$$456,000$, a ratio of approximately 28.5.

6 Appendix

Table 5: Current NFL Pick Value Chart

Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value	Sel.	Value
1	3000	33	580	65	265	97	112	129	43	161	28	193	15.2	225	2.9
2	2600	34	560	66	260	98	108	130	42	162	27.6	194	14.8	226	2.8
3	2200	35	550	67	255	99	104	131	41	163	27.2	195	14.4	227	2.7
4	1800	36	540	68	250	100	100	132	40	164	26.8	196	14	228	2.6
5	1700	37	530	69	245	101	96	133	39.5	165	26.4	197	13.6	229	2.5
6	1600	38	520	70	240	102	92	134	39	166	26	198	13.2	230	2.4
7	1500	39	510	71	235	103	88	135	38.5	167	25.6	199	12.8	231	2.3
8	1400	40	500	72	230	104	86	136	38	168	25.2	200	12.4	232	2.2
9	1350	41	490	73	225	105	84	137	37.5	169	24.8	201	12	233	2.1
10	1300	42	480	74	220	106	82	138	37	170	24.4	202	11.6	234	2
11	1250	43	470	75	245	107	80	139	36.5	171	24	203	11.2	235	1.9
12	1200	44	460	76	210	108	78	140	36	172	23.6	204	10.8	236	1.8
13	1150	45	450	77	205	109	76	141	35.5	173	23.2	205	10.4	237	1.7
14	1100	46	440	78	200	110	74	142	35	174	22.8	206	10	238	1.6
15	1050	47	430	79	195	111	72	143	34.5	175	22.4	207	9.6	239	1.5
16	1000	48	420	80	190	112	70	144	34	176	22	208	9.2	240	1.4
17	950	49	410	81	185	113	68	145	33.5	177	21.6	209	8.8	241	1.3
18	900	50	400	82	180	114	66	146	33	178	21.2	210	8.4	242	1.2
19	875	51	390	83	175	115	64	147	32.6	179	20.8	211	8	243	1.1
20	850	52	380	84	170	116	62	148	32.2	180	20.4	212	7.6	244	1
21	800	53	370	85	165	117	60	149	31.8	181	20	213	7.2	245	0.95
22	780	54	360	86	160	118	58	150	31.4	182	19.6	214	6.8	246	0.9
23	760	55	350	87	155	119	56	151	31	183	19.2	215	6.4	247	0.85
24	740	56	340	88	150	120	54	152	31.6	184	18.8	216	6	248	0.8
25	720	57	330	89	145	121	52	153	31.2	185	18.4	217	5.6	249	0.75
26	700	58	320	90	140	122	50	154	30.8	186	18	218	5.2	250	0.7
27	680	59	310	91	136	123	49	155	30.4	187	17.6	219	4.8	251	0.65
28	660	60	300	92	132	124	48	156	30	188	17.2	220	4.4	252	0.6
29	640	61	292	93	128	125	47	157	29.6	189	16.8	221	4	253	0.55
30	620	62	284	94	124	126	46	158	29.2	190	16.4	222	3.6	254	0.5
31	600	63	276	95	120	127	45	159	28.8	191	16	223	3.3	255	0.45
32	590	64	270	96	116	128	44	160	28.4	192	15.6	224	3		

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