Expected Contract Value: A Holistic Approach to Valuing NFL Contracts

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Bryce Johnston & Nick Barton
bryce.l.johnston@gmail.com | njb50@georgetown.edu

1. Introduction

NFL contracts are difficult to value due to their generally non-guaranteed nature and the variety of ways in which they can be structured. Contracts identify the amount, nature and timing of the amounts to be paid thereunder, but the player will not actually receive the amounts unless he remains on the roster at the time of payment or vesting. While most contracts deviate to some extent by specifying certain amounts as guaranteed at the moment of signing, the effect of the general rule is that the stated value of a contract (the "Stated Value") is not determinative of the amount of money the player will actually receive pursuant to the contract (the "Actual Earnings").

The NFL Collective Bargaining Agreement further complicates the matter by identifying a variety of permissible types of contract amounts [1], each having different salary cap implications in current and future seasons. The differing salary cap treatment of otherwise identical contract amounts allows each team to implement its desired salary cap strategy, but in doing so dictates that seemingly similar contracts may produce different outcomes with respect to Actual Earnings. NFL media, fans, players, agents and teams recognize the problematic nature of contract valuation, but they respond by utilizing conceptually flawed valuation metrics [2, 3]. The most commonly used valuation metrics are Guaranteed Money and Three-Year Payout.[1] "Guaranteed Money" identifies the amount of money fully guaranteed at the time of signing. "Three-Year Payout" identifies the amount of money scheduled to be paid during the first three seasons of the contract.

Guaranteed Money is under-inclusive because it assigns a $0 value to all contract amounts not fully guaranteed at the moment of signing, implying a 0% probability of the player earning such amounts. Three-Year Payout is under-inclusive because it likewise implies a 0% probability of the player earning amounts scheduled for the fourth season of the contract and beyond, but it is also over-inclusive because it assumes a 100% probability of the player earning all amounts scheduled for the first three seasons of the contract. These metrics are flawed because the probability of a player earning any nonguaranteed contract amount is greater than 0% and less than 100%.

Contract analysts overcome this problem to some degree with insightful subjective analysis [4], but such analysis is difficult to perform on a large scale and is subject to human bias. When comparing two contracts, it may be difficult to manually determine which combination of contract components is superior to the other. Even when such a determination is possible, it is difficult to place a numerical value on the superiority of one contract in comparison to the other. When comparing

[1] Metrics such as "average annual value" and "percentage of salary cap space" are used for comparative purposes, but do not speak to the quantity of money a player will earn, and will therefore not be discussed in this paper.

dozens or hundreds of contracts, it becomes extremely difficult to manually synthesize all of the components of every contract. To compensate, analysts tend to place too much emphasis on certain contract characteristics at the expense of others and reach overly simplistic valuation conclusions.

As a result, industry analysis focuses on non-comprehensive value indicators, and contracts are potentially designed inefficiently. Each time a noteworthy contract is signed, members of the media report the contract details in varying and inconsistent ways, and fans are forced to navigate a large collection of confusing contract information and analysis. Agents may negotiate contracts on the basis of conceptually flawed metrics that they anticipate will be reported and will therefore be useful for client recruitment purposes, rather than on the basis of metrics that would be more indicative of maximum expected client earnings. Teams may allocate unnecessary salary cap space toward each contract if uncertainty as to expected earnings results in inflated annual salaries.

Despite the proliferation of advanced metrics across professional sports, no adequate tool currently exists to evaluate NFL contracts. "Contract Analytics" does not yet exist as a subset of sports analytics generally. We introduce a contract value metric that assigns probabilities as to contract termination outcomes – and therefore player earnings – on the basis of contract characteristics.

2. Methodology

2.1. Conceptual Approach

Expected Contract Value produces an output representing the probability a player will remain under contract, for each season of a contract, at the moment of signing. Expected Contract Value represents a probabilistic approach, forecasting expected outcomes as opposed to predicting Actual Earnings. Because Expected Contract Value assigns probabilities for future contract seasons, its inputs consist solely of variables certain at the time of signing. As a result, seemingly important variables such as performance and health are omitted, and the metric instead focuses on characteristics of the contract itself and characteristics inherent to the player. Expected Contract Value forecasts the outcome of a scenario in which a team must make a decision with respect to a contract without knowing which player the contract belongs to. Expected Contract Value incorporates an average of all possible outcomes with respect to performance, health, conduct and other matters, as its inputs encompass a wide variety of such outcomes.

One contract characteristic not taken into consideration, perhaps counter-intuitively, is the salary cap space allocated to a given player in a given season for purposes of salary cap calculations (a player's "Salary Cap Number"). While Salary Cap Number is important from a salary cap accounting perspective, it is generally not relevant from a decision-making perspective because it typically incorporates fixed amounts (such as prorated signing bonus amounts) that cannot be manipulated via team action. As a result, we ignore such "sunk cost" salary cap space and instead focus on the amounts that can be manipulated through team action.

2.2. Input Variables

Expected Contract Value incorporates several numerical relationships we identified as relevant to contract termination decisions (the "Input Variables").

"Save:Avg" measures the ratio of the amount of salary cap space the team would recapture upon releasing the player to the average annual value of the player's contract. We observe that average annual value is an effective proxy for the relative value that the market places on a player. This Input Variable therefore accounts for the salary cap benefit (or lack thereof) of releasing a player in comparison to the value that the team apparently placed on the player at the time of signing. The greater the percentage of the contract's average annual value that would be recaptured upon termination, the more likely the contract will be terminated.

"Contract:Complete" measures the ratio of completed seasons to total seasons in a contract. Because contracts are generally not guaranteed, teams have an option on most contract seasons. According to finance theory, the team option itself has value [5]. This Input Variable therefore accounts for any opportunity for the contract to generate surplus value in contract seasons beyond the current one. The more contract seasons that remain following the current contract season, and therefore the more optionality value remaining, the less likely the contract will be terminated.

"Age:Peak" utilizes a scale to measure the ratio of a player's age to a fixed denominator representing a theoretical peak age. Older players tend to suffer declines in performance – and therefore fail to justify their respective Salary Cap Number – more often and more significantly than younger players. The older the player, the more likely the contract will be terminated.

We also separated players into positional groupings to account for the possibility that teams utilize different criteria to make contract termination decisions based on perceived differences in value as between positions. The positional groupings are Quarterbacks, Running Backs, Pass Catchers, Offensive Lineman, Front Seven, Defensive Backs and Specialists.

2.3. Expected Contract Value

To create the Expected Contract Value model, we first compiled internet-sourced contract data [6, 7, 8] concerning more than 2,400 records of contract seasons occurring prior to 2015 (the "Input Contract Seasons"). For each Input Contract Season, we first identified whether the player in fact received the scheduled salary (the "Salary Outcome"). We then calculated the Input Variables for each Input Contract Season. The Input Variables for each Input Contract Season were calculated as of the very beginning of the given league year (i.e. prior to any base salary vesting dates or option bonus payment dates). We treated pay cuts as contract terminations, as we take the position that a pay cut is substantively indistinguishable from a contract termination followed by a new contract.

We then performed a logistic regression on the Salary Outcome and the Input Variables of the Input Contract Seasons. The resulting model produces outputs representing the probability a player will remain under contract, for each season of a contract, at the moment of signing the contract (an "Expected Outcome"). The Expected Outcome is applied to scheduled salaries and adjusted for guarantees to determine the amount of money the player can expect to earn over the course of a new contract. We created a different model for each positional grouping, but the results of Expected Contract Value are presented without distinguishing as between positional groupings.

2.4. Current Season ECV

We developed a modified version of Expected Contract Value ("Current Season ECV") for the purpose of more accurately forecasting single-season outcomes. To create Current Season ECV, we added an additional Input Variable for each Input Contract Season and then replicated the logistic regression on this basis. "Prior AV" identifies the player's "Approximate Value" as described on Pro Football Reference [9] in the season immediately preceding the given Input Contract Season. At the time that Current Season ECV is applied, each player's Prior AV is known with certainty, which allows us to "update" the Expected Outcome without deviating from the core theoretical principal of only utilizing known inputs. Approximate Value appears to produce intuitive results and is the most easily accessible metric that quantifies value as a common metric across all positions.

2.5. Limitations

The primary limitation of Expected Contract Value is the unofficial nature of the internet-sourced contract data. When calculating the Input Variables, we avoided using contracts for which substantially complete information could not be identified. This removed a significant number of historical contract seasons from the potential sample. While we believe the information for the contracts we did use was correct in all material respects, it was not possible to verify the accuracy of such information. To the extent that the information used to calculate the Input Contract Seasons was inaccurate, the accuracy of Expected Contract Value would correspondingly suffer.

3. Results

3.1. Historical Contracts

Historically, Expected Contract Value has correlated more strongly with Actual Earnings than Stated Value, Guaranteed Money or Three-Year Payout. We calculated each of these metrics for 100 contracts that would have expired no later than the 2015 season by their original terms (the "Historical Contracts"). The applicable players collectively earned approximately $2.1738 billion, representing 68.1% of the aggregate Stated Value. The aggregate Expected Contract Value of the Historical Contracts was approximately $2.1119 billion. As between Expected Contract Value and Actual Earnings, the coefficient of correlation, *r*, is .932. Table 1 shows *r* with respect to each of the valuation metrics. We note that Stated Value is more strongly correlated with Actual Earnings than Three-Year Payout or Guaranteed Money, both of which are used as a result of the inadequacy of Stated Value. Only 24 of the Historical Contracts were terminated after exactly three contract seasons, further casting doubt on the merits of Three-Year Payout.

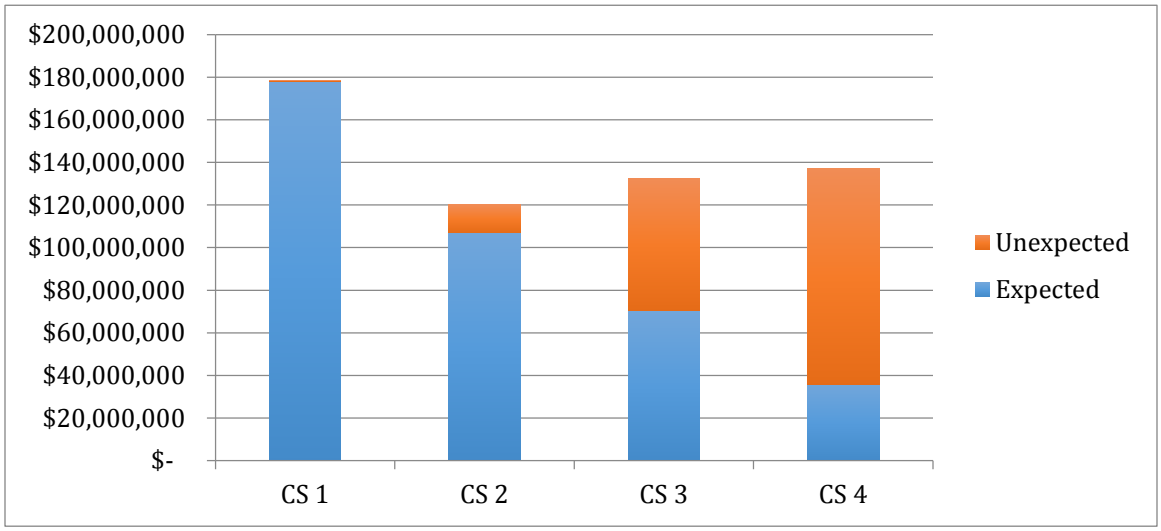
Table 1 – Coefficient of Correlation

Metric	*r*
Expected Contract Value	.932
Stated Contract Value	.868
Three-Year Payout	.822
Guaranteed Money	.762

3.2. 2015 Contracts

We calculated the Expected Contract Value of 78 contracts of four years or more in length signed during the 2015 calendar year by veteran players (the "2015 Contracts"). The aggregate Stated Value of the 2015 Contracts is approximately $3.4931 billion, but the aggregate Expected Contract Value of the 2015 Contracts is approximately $2.5166 billion, or 72% of the aggregate Stated Value. Appendix A displays a comparison of the Expected Contract Value of the 2015 Contracts to the Stated Value, Guaranteed Money and Three-Year Payout. Figure 1 shows that even as contract amounts rise in later contract seasons, the amount the player can expect to earn decreases. Appendix B contains similar charts for five-year contracts and six-year contracts. Appendix C includes the Expected Contract Value calculations of certain noteworthy 2015 Contracts.

Figure 1 – 2015 Contracts – Four-Year Contracts (Aggregate)



We find that differences in Expected Contract Value between similarly sized contracts can be explained in part by the structure of the contract. Guaranteed contract amounts most often come in the form of signing bonuses or guaranteed base salary (guaranteed roster bonuses, for this purpose, are treated the same as guaranteed base salary). Table 2 shows that Expected Contract Value as a percentage of Stated Value tends to increase as the percentage of guaranteed money comprised of signing bonus increases. In other words, a player would be better off receiving guaranteed money in the form of a signing bonus than in the form of guaranteed base salary or roster bonus. This is because in any contract that includes a signing bonus, a player possesses some protection against contract termination in future seasons as a result of the "Dead Money" that would result from the acceleration of prorated signing bonus amounts upon contract termination.

Table 2 – Effect of Dead Money Protection	
Signing Bonus as a Percentage of Guaranteed Money	Expected Contract Value as a Percentage of Stated Value
<33%	67.4%
33% - 67%	72.6%
>67%	73.9%

Certain contracts contain provisions that cause the base salary in a future contract season to become fully guaranteed as of a certain date in the present contract season. We refer to such provisions as "Accelerated Team Option Deadlines" or "ATODs". Most players who sign long-term contracts remain under contract through at least the second season of the contract. As a result, if the third contract season becomes guaranteed at the beginning of the second contract season, the player will also very likely remain under contract through the third contract season. Accelerated Team Option Deadlines therefore significantly increase Expected Contract Value. Table 3 shows the increase in Expected Contract Value and Expected Outcome that would result if we insert an ATOD (2nd season triggering 3rd season) into the 2015 Contracts that do not currently include an ATOD.

Table 3 – Effect of Accelerated Team Option Deadline

	Existing Terms	With Hypothetical ATOD (3rd Contract Season Triggered in 2nd)
Third Contract Season ECV (Aggregate – 66 Contracts)	$311,435,139	$382,946,131
Third Contract Season ECV (Per Player)	$4,718,714	$5,802,214
Third Contract Season Expected Outcome (Per Player)	70.2%	86.9%

We find that Expected Contract Value typically decreases when a player is traded. Once a player is traded, the new team would not incur any Dead Money upon contract termination, as all of the prorated signing bonus amounts will have accelerated as Dead Money to the original team upon the trade. As a result, the new team saves more salary cap space upon contract termination following the trade than the original team would have saved upon contract termination prior to the trade. The player therefore possesses less protection against contract termination following the trade. Table 4 shows the decrease in Expected Contract Value and Expected Outcome that would result if we simulate a trade of each 2015 Contracts that included a signing bonus.

Table 4 – Effect of Trade

	Existing Terms	Hypothetical Trade During Third Contract Season
Fourth Season ECV (Aggregate – 47 Contracts)	$248,158,901	$215,631,888
Fourth Contract Season ECV (Per Player)	$5,279,977	$4,587,913
Fourth Contract Season Expected Outcome (Per Player)	58.6%	51.3%

Table 5 displays Expected Contract Value as a percentage of Stated Value for each of the positional groupings. We speculate that Specialists and Quarterbacks tend to score well due to favorable aging patterns and positional scarcity, respectively. The placement of Pass Catchers and Defensive Backs suggests that some of the contracts signed by players in those position groups during 2015 may have been inflated with contract amounts unlikely to be earned.

Table 5 – Expected Earnings By Position	
Positional Grouping	Expected Contract Value as a Percentage of Stated Value
Specialists	84.9%
Quarterbacks	76.8%
Offensive Lineman	73.8%
Front Seven	72.6%
Pass Catchers	69.5%
Running Backs	68.8%
Defensive Backs	65.3%

3.3. 2015 Contract Seasons

We calculated Current Season ECV for 480 players signed for the 2015 season under preexisting contracts (the "2015 Contract Seasons") and subsequently tracked whether the 2015 Contract Seasons ultimately remained in effect on original terms (the "2015 Outcomes"). Table 6 displays the 2015 Outcomes for each Expected Outcome quartile.

Table 6 – 2015 Outcomes	
Expected Outcome Quartile	Percentage of Players Within Quartile Whose 2015 Outcome = Remain Under Contract
75-100%	95%
50-74.9%	71%
25-49.9%	61%
0-24.9%	44%

Current Season ECV tends to overestimate to some degree the likelihood that each contract will be terminated, but the Expected Outcome of the 2015 Contract Seasons and the 2015 Outcomes are positively correlated. Anecdotally speaking, Current Season ECV appears to generate more success identifying which underperforming players *will not be released* due to contract considerations than identifying which adequately performing players *will be released* due to contract considerations.

3.4. Input Variables

Each of the Input Variables possess a p-value of <0.0001 when we do not separate players into positional groupings. When we separate players into positional groupings (in order to increase *r* for the model as a whole), the p-values fluctuate between the position-specific models but remain statistically significant in most cases. Given the simplicity of the model, we opted to include all of the Input Variables in each of the position-specific models. We realize that the log-odds for Input Variables with p-values greater than .05 may be a product of over fitting, but the overall impact on the predictive nature of the model is minimal.[2] It is difficult to include position as a variable given the varying log-odds for each variable for each position. Appendix D displays the p-values of the Input Variables.

[2] When we remove Input Variables with p-values greater than .05 from the position-specific models, the coefficient of correlation, *r*, increases from .932 to .934 for the model as a whole.

4. Discussion

4.1. Contract Negotiation

Agents can utilize Expected Contract Value to negotiate contracts that maximize client earnings. We have demonstrated that Expected Contract Value more strongly correlates to Actual Earnings than Stated Value, Guaranteed Money or Three-Year Payout. Agents may perform a disservice to their clients to the extent they currently negotiate contracts on the basis of the precedents set with respect to those other metrics. It is possible that a contract with less Guaranteed Money and a smaller Stated Value may have a higher Expected Contract Value than a deal with more Guaranteed Money and a larger Stated Value. Expected Contract Value weighs the importance of a variety of earning factors, rather attributing an inappropriate degree of importance to any specific factor.

Expected Contract Value sheds light on contract renegotiation demands. In some instances, a player who is already well compensated relative to his peers demands a new contract. Such a demand may not be justified on the basis of the size of the contract, but rather on the probability the player will receive the amounts. The agent may realize that the player has a low probability of remaining under contract in upcoming contract seasons if the Input Variables are not altered to increase the Expected Outcomes. Demanding to renegotiate the contract therefore becomes logical regardless of the current level of compensation. Expected Contract Value quantifies upcoming decreases in Expected Outcome and can be used to anticipate contract disputes.

Table 7 shows the Expected Contract Value calculations for the contract Terrell Owens signed in 2004 with the Philadelphia Eagles. The contract only included a $2.3 million signing bonus, thereby offering little Dead Money protection in future contract seasons. Furthermore, the third contract season contained a relatively large roster bonus in addition to an option bonus. Between the lack of Dead Money protection and the spike in Salary Cap Number, the Expected Outcome decreased significantly from the second contract season to the third contract season. One can imagine that Drew Rosenhaus came to the same conclusion based on a subjective analysis of the contract. It is therefore not surprising that Owens demanded a new contract in 2005. While the dispute may have been framed in terms of a desire for additional compensation, we hypothesize that the real issue was the low probability of Owens receiving the existing contract amounts.

Table 7 – Terrell Owens Contract Dispute

Terrell Owens

Stated Value: $48,680,000

Year	Salary	Expected Outcome	Expected Value	Adjustment
2004	$660,000	88.1%	$581,570	$8,500,000
2005	$3,250,000	69.1%	$2,246,469	---
2006	$8,270,000	33.9%	$2,806,460	---
2007	$5,500,000	33.2%	$1,825,704	---
2008	$6,500,000	15.1%	$982,294	---
2009	$7,500,000	6.0%	$449,758	---
2010	$8,500,000	3.0%	$253,311	---
Subtotal			$9,145,566	$8,500,000
Total			**$17,645,566 (36.2%)**	

4.2. Strategic Planning

Teams can use Expected Contract Value to budget salary cap space in a probabilistic manner. We calculate "Expected Cap Number" by multiplying a player's Expected Outcome in any future contract season by the player's scheduled Salary Cap Number. Because accurately projecting future player performance remains very difficult, the most effective way for teams to forecast future salary cap space is to utilize an ECV-based metric that does not take player performance into account at all. While Expected Cap Number would not be accurate for any specific player due to the either/or nature of contract termination decisions, the aggregate Expected Cap Numbers for any team in any season would likely be more accurate than any manual method of predicting whether each player will be released years into the future. Appendix E illustrates an example of this approach.

Teams can utilize Expected Contract Value to assist in the development of offseason plans. Many players are released prior to the beginning of each free agency period, and such releases have an impact on supply and demand in the free agent market. The speed at which the pool of talent in the free agent market is exhausted dictates that the teams with the most well developed plans are more likely to execute their desired transactions. As a result, Current Season ECV offers advantages to the extent it forecasts contract terminations more accurately than subjective methods.

4.3. Shifting the Market

Teams and agents can utilize Expected Contract Value to design contracts more efficiently. We observe that many contracts are longer than would be optimal from the player's perspective. Rather than sign short contracts that allow the player to return to free agency following the portion of the contract that is predominantly guaranteed, many contracts include additional contract seasons that subject the player to team control for contract seasons in which the contract amounts are rather unlikely to be earned. The contract market may have developed in such a way that teams demand these option years as a tradeoff for enhancing the compensation in the contract, effectively "overpaying" players in order to obtain optionality. However, when contract amounts in the team option seasons are too large to realistically be exercised, they are unhelpful to both the team and the player. In such a case, both the value of the team option and the player's probability of earning the contract amount remain low. Both parties would be better off avoiding excessive contract back loading, and Expected Contract Value can help to identify the optimum balance.

While much discussion has taken place as to whether any veteran player will ever sign a fully guaranteed contract, it seems likely that teams would be willing to offer fully guaranteed contracts at this moment, but only in an amount sufficiently lower than current market amounts to offset the decrease in optionality. Expected Contract Value can help to identify an appropriate amount. We illustrate this point using the contract signed by DeMarco Murray during 2015 free agency. The contract includes a Stated Value of $40,000,000 and Guaranteed Money in the amount of $18,000,000. The relevant question is not whether a 2016 version of DeMarco Murray would sign a contract with a Stated Value of $40,000,000 but Guaranteed Money in the amount of $40,000,000 instead of $18,000,000. The relevant question is whether a 2016 version of DeMarco Murray would sign a fully guaranteed contract at some Stated Value less than $40,000,000 but greater than $18,000,000. Expected Contract Value facilitates this discussion by identifying DeMarco Murray's expected earnings as $25,760,340. This amount becomes the starting point for negotiating a fully guaranteed contract with a 2016 version of DeMarco Murray.

A team would not necessarily prefer to sign a 2016 version of DeMarco Murray to a $25,760,340 contract that is fully guaranteed instead of a $40,000,000 contract that includes $18,000,000 worth of guarantees, but a team could decide that the salary cap savings over the course of such a contract would justify the loss in optionality and increased risk. Such a determination is simply a question of weighing risks and benefits for both the player and the team. In any event, Expected Contract Value would serve as the bridge from the current contract market to a possible future contract market in which players sign fully guaranteed contracts for smaller amounts.

5. Conclusion

Expected Contract Value demonstrates that probabilistic contract outcomes can be forecasted in advance, with a relatively high degree of accuracy, by accounting for nothing other than contract characteristics known with certainty at the time of signing. Expected Contract Value incorporates the considerations inherent in all of the currently popular valuation metrics, but weights them appropriately and presents the information in a single, easily understood format. Widespread usage of Expected Contract Value will lead to more coherent media coverage and less fan confusion. An objective, comprehensive metric will enable easy comparison of existing and prospective contracts, thereby facilitating negotiation, planning, analysis and debate.

References

[1] Article XIII, NFL Collective Bargaining Agreement, by and between the National Football League Management Council and the National Football League Players Association (August 4, 2011). Available at: https://nfllabor.files.wordpress.com/2010/01/collective-bargaining-agreement-2011-2020.pdf.

[2] Florio, Mike. The full Dez Bryant deal (July 18, 2015). Retrieved from http://profootballtalk.nbcsports.com/2015/07/18/the-full-dez-bryant-deal/.

[3]Brandt, Andrew. Inside Russell Wilson's Deal (August 6, 2015). Retrieved from http://mmqb.si.com/mmqb/2015/08/06/russell-wilson-seattle-seahawks-new-contract-nfl.

[4] Corry, Joel. Agent's Take: How your team structures deals – and why it matters (June 20, 2014). Retrieved from http://www.cbssports.com/nfl/eye-on-football/24593244/agents-take-how-your-team-structures-deals----and-why-it-matters.

[5] Shen, Eugene. Optionality in NFL Player Contracts (May 8, 2014). Available at SSRN: http://ssrn.com/abstract-2434640 or http://dx.doi.org/10.2139/ssrn.2434640.

[6] Fitzgerald, Jason (2015). Numerous pages. Retrieved from http://overthecap.com/.

[7] Whetstone, Ian (Undated). Numerous online documents. Retrieved from http://ianwhetstone.com/football/cap.html.

[8] Spotrac, partnered with the USA TODAY Sports Media Group (2015). Numerous pages. Retrieved from http://www.spotrac.com/.

[9] Pro Football Reference (2015). Numerous pages. Retrieved from http://www.pro-football-reference.com/.

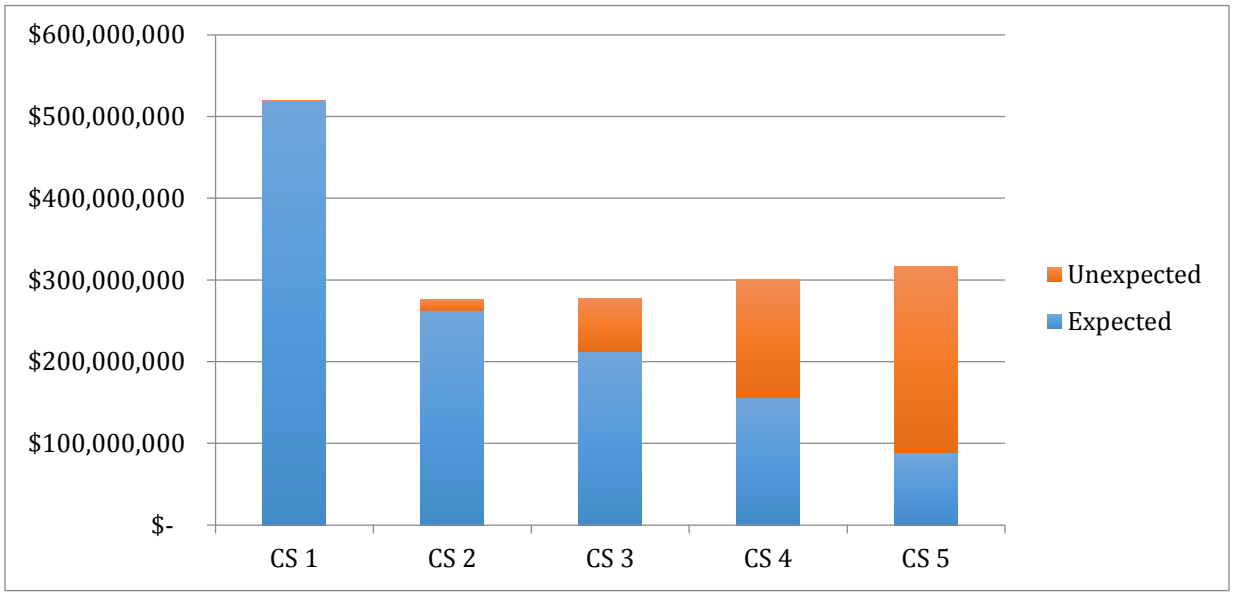
Appendix A: 2015 Contracts – Valuation Metric Comparison

Player	Stated Value	Guaranteed	Three-Year	ECV	Exp.
C. Newton	$118,466,000	$41,000,000	$67,666,000	**$96,105,789**	**81%**
M. Dareus	$103,160,000	$42,900,000	$53,150,000	**$80,286,658**	**78%**
N. Suh	$114,375,000	$59,955,000	$60,000,000	**$77,690,609**	**68%**
E. Manning	$101,000,000	$36,500,000	$68,000,000	**$76,914,350**	**76%**
Roethlisberger	$99,000,000	$34,250,000	$65,000,000	**$76,082,397**	**77%**
P. Rivers	$99,000,000	$37,500,000	$68,000,000	**$75,959,937**	**77%**
R. Wilson	$89,142,000	$31,700,000	$56,642,000	**$74,447,318**	**84%**
J. Houston	$101,000,000	$32,500,000	$53,000,000	**$73,358,487**	**73%**
R. Tannehill	$95,272,523	$21,500,000	$39,500,000	**$63,001,809**	**66%**
T. Williams	$78,250,000	$30,000,000	$44,000,000	**$59,404,436**	**76%**
J. Jones	$81,426,000	$35,500,000	$47,000,000	**$56,461,403**	**69%**
D. Bryant	$70,000,000	$32,000,000	$45,000,000	**$53,926,383**	**77%**
AJ Green	$70,176,000	$26,750,000	$47,250,000	**$51,207,466**	**73%**
D. Thomas	$70,000,000	$35,000,000	$47,500,000	**$49,271,094**	**70%**
D. Revis	$70,121,060	$39,000,000	$49,000,000	**$47,636,614**	**68%**
C. Jordan	$61,969,000	$22,969,000	$33,669,000	**$46,935,635**	**76%**
R. Kerrigan	$64,538,000	$23,788,000	$32,788,000	**$44,081,397**	**68%**
C. Heyward	$59,250,000	$16,000,000	$32,000,000	**$43,993,190**	**74%**
C. Liuget	$56,727,000	$13,977,000	$30,477,000	**$43,573,179**	**77%**
A. Castonzo	$51,250,000	$18,000,000	$35,000,000	**$41,050,450**	**80%**
TY Hilton	$66,542,000	$11,000,000	$28,000,000	**$38,550,097**	**58%**
M. Pouncey	$52,188,000	$11,000,000	$28,000,000	**$38,545,413**	**74%**
B. Maxwell	$63,000,000	$22,000,000	$32,500,000	**$37,549,043**	**60%**
T. Crawford	$45,675,000	$17,425,000	$24,675,000	**$35,704,836**	**78%**
L. David	$51,113,418	$10,738,418	$21,863,418	**$35,474,979**	**69%**
J. Hughes	$45,000,000	$17,625,000	$28,000,000	**$35,324,323**	**78%**
J. Maclin	$55,000,000	$22,500,000	$33,000,000	**$35,309,689**	**64%**
R. Hudson	$44,500,000	$12,650,000	$27,550,000	**$33,264,683**	**75%**
D. McCourty	$47,500,000	$22,000,000	$30,000,000	**$33,050,857**	**70%**
J. Smith	$48,000,000	$21,000,000	$29,500,000	**$32,941,463**	**69%**
C. Clay	$38,000,000	$24,500,000	$29,000,000	**$32,938,004**	**87%**
B. Wagner	$43,977,427	$8,977,427	$21,477,427	**$32,595,145**	**74%**
J. Thomas	$46,000,000	$21,000,000	$28,300,000	**$30,264,197**	**66%**
R. Cobb	$40,000,000	$13,000,000	$30,500,000	**$29,802,045**	**75%**
L. McCoy	$40,050,000	$15,750,000	$27,300,000	**$29,198,785**	**73%**
J. Odrick	$42,500,000	$17,000,000	$25,500,000	**$28,444,180**	**67%**
D. Levy	$37,240,000	$13,000,000	$24,240,000	**$27,679,768**	**74%**
P. McPhee	$38,750,000	$8,750,000	$23,175,000	**$27,338,955**	**71%**
M. Iupati	$40,000,000	$15,750,000	$24,000,000	**$27,203,224**	**68%**
D. Murray	$40,000,000	$18,000,000	$24,000,000	**$26,190,674**	**65%**
K. Jackson	$34,000,000	$20,000,000	$27,250,000	**$25,913,762**	**76%**
B. Bulaga	$33,750,000	$8,000,000	$20,250,000	**$25,794,421**	**76%**
T. Smith	$40,000,000	$8,750,000	$24,000,000	**$25,386,041**	**63%**

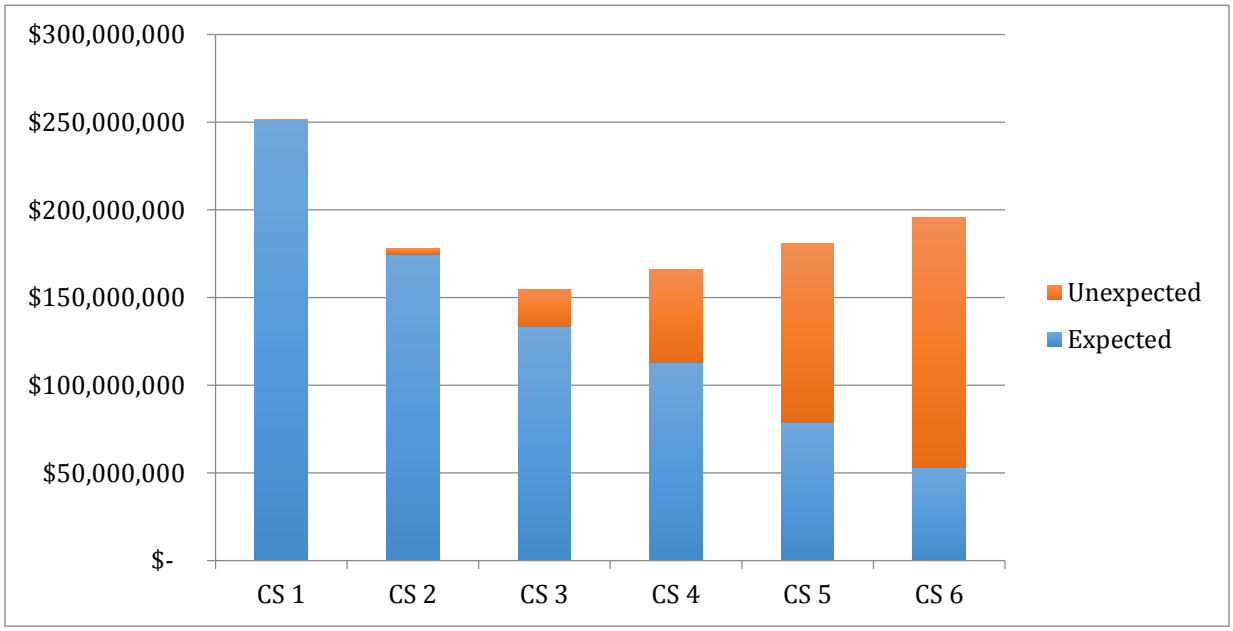
O. Franklin	$36,500,000	$16,500,000	$22,800,000	**$25,349,841**	**69%**
M. Kendricks	$29,996,060	$11,746,060	$16,996,060	**$24,744,387**	**82%**
B. Flowers	$36,400,000	$18,000,000	$27,000,000	**$22,520,113**	**62%**
J. Parnell	$32,000,000	$14,500,000	$21,000,000	**$21,734,673**	**68%**
W. Mercilus	$27,431,012	$10,681,012	$15,931,012	**$21,595,895**	**79%**
C. Culliver	$32,000,000	$16,000,000	$24,000,000	**$21,006,156**	**66%**
D. Newton	$26,500,000	$10,000,000	$17,000,000	**$20,589,894**	**78%**
D. Morgan	$27,000,000	$8,500,000	$20,000,000	**$20,410,800**	**76%**
D. Williams	$25,000,000	$15,200,000	$20,000,000	**$19,549,249**	**78%**
C. Boling	$26,000,000	$5,000,000	$15,800,000	**$19,444,184**	**75%**
B. Graham	$26,000,000	$13,000,000	$19,500,000	**$19,023,345**	**73%**
K. Dunlap	$28,000,000	$8,500,000	$20,750,000	**$18,718,310**	**67%**
B. Orakpo	$31,000,000	$8,000,000	$23,250,000	**$18,675,922**	**60%**
B. Skrine	$25,000,000	$13,000,000	$19,000,000	**$17,328,857**	**69%**
D. House	$24,500,000	$10,000,000	$18,500,000	**$16,077,803**	**66%**
B. Reed	$22,500,000	$6,900,000	$13,500,000	**$15,898,605**	**71%**
S. Paea	$21,000,000	$7,850,000	$16,000,000	**$15,840,553**	**75%**
S. Gostkowski	$17,200,000	$10,100,000	$13,700,000	**$15,639,855**	**91%**
D. Searcy	$23,750,000	$7,000,000	$17,625,000	**$15,403,017**	**65%**
N. Allen	$23,000,000	$6,900,000	$18,000,000	**$14,613,639**	**64%**
J. Carpenter	$19,100,000	$5,000,000	$14,400,000	**$14,367,416**	**75%**
S. Koch	$18,750,000	$5,000,000	$9,600,000	**$14,269,878**	**76%**
M. Johnson	$20,000,000	$4,500,000	$14,975,000	**$13,717,613**	**69%**
R. Parker	$25,000,000	$5,750,000	$12,500,000	**$13,009,705**	**52%**
M. Gilchrist	$22,000,000	$3,500,000	$16,000,000	**$12,648,703**	**57%**
B. Kern	$15,000,000	$5,000,000	$9,000,000	**$12,581,088**	**84%**
B. Walsh	$13,660,000	$3,750,000	$7,660,000	**$12,333,605**	**90%**
D. Harris	$17,500,000	$7,100,000	$11,000,000	**$11,925,102**	**68%**
M. Ingram	$16,000,000	$6,100,000	$11,400,000	**$11,601,561**	**73%**
L. Kendricks	$18,500,000	$6,750,000	$14,350,000	**$11,379,962**	**62%**
B. Carter	$17,000,000	$4,250,000	$12,750,000	**$11,254,385**	**66%**
D. Skuta	$20,500,000	$4,600,000	$12,300,000	**$11,013,732**	**54%**
CJ Spiller	$16,000,000	$5,750,000	$12,600,000	**$10,546,530**	**66%**
K. Langford	$17,200,000	$2,500,000	$13,000,000	**$10,092,721**	**59%**
J. Felton	$9,200,000	$3,600,000	$7,200,000	**$5,854,325**	**64%**
Total	**$3,493,095,500**	**$1,281,731,917**	**$2,145,809,917**	**$2,516,614,610**	**72%**

Appendix B: Proportion of Expected v Unexpected Earnings

2015 Contracts – Five-Year Contracts (Aggregate):



2015 Contracts – Six-Year Contracts (Aggregate):



Appendix C: 2015 Contracts – Selected Examples

Cam Newton				
Stated Value: $118,466,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.6%	---	$31,000,000
2016	$13,000,000	97.0%	$12,613,291	$10,000,000
2017	$13,666,000	92.4%	$12,626,604	---
2018	$15,000,000	81.1%	$12,167,537	---
2019	$16,700,000	59.6%	$9,958,235	---
2020	$19,100,000	40.5%	$7,740,123	---
Subtotal			$55,105,789	$41,000,000
Total			**$96,105,789 (81%)**	

Russell Wilson				
Stated Value: $89,142,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.3%	---	$31,700,000
2016	$12,342,000	95.9%	$11,834,960	---
2017	$12,600,000	89.8%	$11,314,832	---
2018	$15,500,000	73.2%	$11,350,832	---
2019	$17,000,000	48.5%	$8,246,694	---
Subtotal			$42,747,318	$31,700,000
Total			**$74,447,318 (84%)**	

Ryan Tannehill				
Stated Value: $95,272,523				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.0%	---	$12,160,000
2016	---	96.5%	---	$9,340,000
2017	$18,000,000	81.4%	$14,647,779	---
2018	$17,500,000	64.5%	$11,295,594	---
2019	$18,750,000	46.7%	$8,765,427	---
2020	$19,525,000	34.8%	$6,793,009	
Subtotal			$41,501,809	$21,500,000
Total			**$63,001,809 (66%)**	

LeSean McCoy				
Stated Value: $40,050,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.2%	---	$16,000,000
2016	$2,550,000	95.0%	$2,422,287	$2,500,000
2017	$6,250,000	76.3%	$4,770,746	---
2018	$6,325,000	41.6%	$2,632,532	---
2019	$6,425,000	13.6%	$873,220	---
Subtotal			$10,698,785	$18,500,000
Total			**$29,198,785 (73%)**	

DeMarco Murray				
Stated Value: $40,000,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.0%	---	$9,000,000
2016	---	94.9%	---	$7,000,000
2017	$6,000,000	72.2%	$4,331,000	$2,000,000
2018	$8,000,000	35.9%	$2,875,698	---
2019	$8,000,000	12.3%	$983,976	---
Subtotal			$8,190,674	$18,000,000
Total			**$26,190,674 (65%)**	

Trent Williams				
Stated Value: $78,250,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	$2,250,000	99.5%	$2,239,562	$13,250,000
2016	$250,000	98.3%	$245,858	$16,750,000
2017	$11,500,000	88.7%	$10,199,662	---
2018	$10,250,000	75.5%	$7,741,038	---
2019	$11,250,000	49.9%	$5,617,590	
2020	$12,750,000	26.4%	$3,360,726	
Subtotal			$29,404,436	$30,000,000
Total			**$59,404,436 (76%)**	

Julio Jones				
Stated Value: $81,426,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.8%	---	$22,000,000
2016	---	96.8%	---	$13,500,000
2017	$11,500,000	72.3%	$8,310,298	---
2018	$10,500,000	57.2%	$6,001,910	---
2019	$12,500,000	30.8%	$3,848,918	---
2020	$11,426,000	24.5%	$2,800,277	
Subtotal			$20,961,403	$35,500,000
Total			**$56,461,403 (69%)**	

Dez Bryant				
Stated Value: $70,000,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.8%	---	$23,000,000
2016	---	98.3%	---	$9,000,000
2017	$13,000,000	95.0%	$12,353,646	---
2018	$12,500,000	50.9%	$6,358,005	---
2019	$12,500,000	25.7%	$3,214,732	---
Subtotal			$21,926,383	$32,000,000
Total			**$53,926,383 (77%)**	

AJ Green				
Stated Value: $70,176,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	98.5%	---	$26,750,000
2016	$10,000,000	87.1%	$8,712,093	---
2017	$10,500,000	71.6%	$7,514,962	---
2018	$10,750,000	49.2%	$5,291,721	---
2019	$12,176,000	24.1%	$2,938,690	---
Subtotal			$24,457,466	$26,750,000
Total			**$51,207,466 (73%)**	

Marcel Dareus				
Stated Contract Value: 103,160,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.9%	---	$28,000,000
2016	$250,000	99.5%	$248,807	$14,900,000
2017	$10,000,000	98.7%	$9,868,074	---
2018	$10,175,000	93.7%	$9,535,208	---
2019	$10,585,000	70.3%	$7,436,511	---
2020	$14,600,000	43.1%	$6,297,741	
2021	$14,650,000	27.3%	$4,000,317	
Subtotal			$37,386,658	$42,900,000
Total			**$80,286,658 (78%)**	

Ndamukong Suh				
Stated Contract Value: $114,375,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	$15,000	99.8%	$14,974	$26,485,000
2016	$15,000	98.6%	$14,795	$23,485,000
2017	$15,000	92.5%	$13,870	$9,985,000
2018	$17,000,000	56.6%	$9,617,693	---
2019	$19,000,000	27.4%	$5,214,755	---
2020	$18,360,000	15.6%	$2,859,522	---
Subtotal			$17,735,609	$59,955,000
Total			**$77,690,609 (68%)**	

Justin Houston				
Stated Contract Value: $101,000,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.8%	---	$21,500,000
2016	$4,000,000	98.0%	$3,918,711	$11,000,000
2017	$16,500,000	91.4%	$15,084,624	---
2018	$15,000,000	71.0%	$10,649,413	---
2019	$15,500,000	44.7%	$6,922,351	---
2020	$17,500,000	24.5%	$4,283,389	
Subtotal			$40,858,487	$32,500,000
Total			**$73,358,487 (73%)**	

Darrelle Revis				
Stated Contract Value: $70,121,060				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.5%	---	$16,000,000
2016	---	92.7%	---	$17,000,000
2017	$9,000,000	49.3%	$4,931,783	$6,000,000
2018	$11,000,000	24.7%	$2,482,167	---
2019	$11,000,000	12.2%	$1,222,664	---
Subtotal			$8,636,614	$39,000,000
Total			**$47,636,614 (68%)**	

Byron Maxwell				
Stated Contract Value: $63,000,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	---	99.6%	---	$13,500,000
2016	---	96.2%	---	$8,500,000
2017	$10,500,000	67.0%	$7,039,506	---
2018	$10,000,000	46.3%	$4,630,091	---
2019	$9,750,000	26.0%	$2,538,229	---
2020	$10,750,000	12.5%	$1,341,217	---
Subtotal			$15,549,043	$22,000,000
Total			**$37,549,043 (60%)**	

Devin McCourty				
Stated Contract Value: $47,500,000				
Year	Salary	Expected Outcome	Expected Value	Adjustment
2015	$500,000	99.7%	$498,501	$17,500,000
2016	$500,000	97.6%	$487,808	$4,500,000
2017	$7,000,000	77.5%	$5,424,907	---
2018	$8,000,000	42.7%	$3,414,544	---
2019	$9,500,000	12.9%	$1,225,097	---
Subtotal			$11,050,857	$22,000,000
Total			**$33,050,857 (70%)**	

Appendix D: p-values of Input Variables

Save:Avg – Expected Contract Value	
Positional Grouping	p-value
Quarterbacks	<.0001
Running Backs	.1867
Pass Catchers	.0002
Offensive Lineman	.0029
Front Seven	<.0001
Defensive Backs	.0007
Specialists	<.0001

Age:Peak – Expected Contract Value	
Positional Grouping	p-value
Quarterbacks	.0293
Running Backs	<.0001
Pass Catchers	.0009
Offensive Lineman	<.0001
Front Seven	<.0001
Defensive Backs	.0096
Specialists	.0015

Contract:Complete – Expected Contract Value	
Positional Grouping	p-value
Quarterbacks	.0258
Running Backs	<.0001
Pass Catchers	.2351
Offensive Lineman	.0010
Front Seven	.0050
Defensive Backs	.0005
Specialists	.6542

Save:Avg – Current Season ECV	
Positional Grouping	p-value
Quarterbacks	.0016
Running Backs	.2865
Pass Catchers	<.0001
Offensive Lineman	.0414
Front Seven	.0008
Defensive Backs	.0019
Specialists	.0147

Age:Peak – Current Season ECV	
Positional Grouping	p-value
Quarterbacks	.0735
Running Backs	<.0001
Pass Catchers	<.0001
Offensive Lineman	<.0001
Front Seven	<.0001
Defensive Backs	.0005
Specialists	.0015

Contract:Complete – Current Season ECV	
Positional Grouping	p-value
Quarterbacks	.1197
Running Backs	<.0001
Pass Catchers	.1427
Offensive Lineman	<.0001
Front Seven	.1348
Defensive Backs	.0013
Specialists	.2800

Prior AV – Current Season ECV	
Positional Grouping	p-value
Quarterbacks	<.0001
Running Backs	<.0001
Pass Catchers	<.0001
Offensive Lineman	<.0001
Front Seven	<.0001
Defensive Backs	<.0001
Specialists	<.0001

Appendix E: Team Cap Budgeting Example (Seattle Seahawks)

2017 Season						
Player	Pos	Cap Number	Probability	Dead Money	Probability	**Weighted Avg**
Russell Wilson	QB	$18,800,000	89.8%	$18,600,000	10.2%	**$18,779,600**
Richard Sherman	DB	$13,361,000	48.3%	$4,400,000	51.7%	**$8,728,163**
Marshawn Lynch	RB	$12,500,000	13.4%	$2,500,000	86.6%	**$3,840,000**
Earl Thomas	DB	$10,400,000	52.6%	$3,800,000	47.4%	**$7,271,600**
Jimmy Graham	TE	$10,000,000	21.8%	$0	78.2%	**$2,180,000**
Michael Bennett	DL	$9,500,000	24.2%	$2,000,000	75.8%	**$3,815,000**
Kam Chancellor	DB	$8,125,008	21.0%	$1,000,000	79.0%	**$2,496,252**
Bobby Wagner	LB	$7,600,000	93.0%	$7,800,000	7.0%	**$7,614,000**
KJ Wright	LB	$6,800,000	69.0%	$2,000,000	31.0%	**$5,312,000**
Cliff Avril	DL	$5,500,000	47.8%	$1,000,000	52.2%	**$3,151,000**
Total		$102,586,008				**$63,187,615**

2018 Season						
Player	Pos	Cap Number	Probability	Dead Money	Probability	**Weighted Avg**
Russell Wilson	QB	$21,700,000	73.2%	$12,400,000	26.8%	**$19,207,600**
Richard Sherman	DB	$13,200,000	23.9%	$2,200,000	76.1%	**$4,829,000**
Marshawn Lynch	RB					
Earl Thomas	DB	$10,400,000	25.8%	$1,900,000	74.2%	**$4,093,000**
Jimmy Graham	TE					
Michael Bennett	DL					
Kam Chancellor	DB					
Bobby Wagner	LB	$13,600,000	67.0%	$5,200,000	33.0%	**$10,828,000**
KJ Wright	LB	$8,200,000	37.7%	$1,000,000	62.3%	**$3,714,400**
Cliff Avril	DL	$8,000,000	18.6%	$500,000	81.4%	**$1,895,000**
Total		$75,100,000				**$44,567,000**