The Free Agency Market In Major League Baseball:

Examining Demand for Free Agents

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Abstract

This paper looks at the question of how much demand there is for a specific player in the Major League Baseball free agency market. In this very unique market, General Managers must ask themselves what other teams they are competing against to get the services of a certain player. Then, once they do figure out who they are competing against, is the cost just too high for their team. By using WAR as the main variable to determine a player's worth to a team, it can be observed how much of an increase in productivity to a certain ball club can be obtained by signing the free agent. Then using information on how much a certain team values the increase in one unit of war, projected demand can be examined for each baseball team. This model can be used to predict demand for certain free agents and then their probable destinations.

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Introduction

In a day when the Los Angeles Dodgers franchise sells for 2.15 billion dollars (espn.com), there is a great demand from owners of Major League Baseball (MLB) teams to put together competitive lineup. The job of putting together these competitive teams is given to the General Manager, which they must also deal with the problem of not overpaying for players. In the MLB, there is no salary cap, which means owners of teams are free to spend whatever the feel like, and teams with low budgets are forced to compete with teams which have deep pockets. For other owners, there is a strict cap on the amount of money that they have available to pay players and place a strict limit on the pay roll that their general managers can use to put together the best team possible. These owners will still expect to compete, and even beat these unlimited payroll teams. The question is how is this even possible when wealthy teams can buy the best players in the Free Agency market?

In 2011, the film "Money Ball" was released and introduced everyone into the young field of Sabermetrics. Sabermetrics is a field of study where baseball is broken down and examined by numbers and not just by the old fashion "eye test" to determine how talented a player was. The movie focused on the general manager of the Oakland Athletics, Billy Bean, and his attempt to put together competitive teams. Bean did this by choosing players based on the numbers they produced, and not the by just signing perennial All Stars at a high cost because of the strict limit place on him on payroll by the owner. This year, the Oakland Athletics once again made the playoffs with the 29th lowest payroll out of 30 teams. (USA Today) The question is how are the Athletics able to outperform teams like the New York Yankees with more than three times their own payroll?

To help answer this question, it is crucial to look at the free agent market where teams

can make the quickest and biggest changes to their lineups by signing available players in the free agency market. In the free agency market, general managers can chooses to sign whoever they want to try and upgrade certain positions in their current lineup to put together a winning team. The question comes down to how much a team is willing to pay for the players services and if there is another team who is willing to pay more.

Many papers have looked into the question if players are played too much based on their Marginal Revenue Product (MRP), what statistic is best for evaluating performance that leads to an increase in team win percentage, and if the free agent market has affected the distribution of talent amongst the teams. Very few have looked into the question on how to model demand for the free agents among the thirty major league ball clubs. Many general managers need to know who they are competing with, how many teams they might be competing with and what a team might be willing to offer. Then a general manager can make the decision to give a larger winning bid than other competing teams, or concede that the cost is too much for the free agent.

There is a lack of research that looks into the question of how well the statistic Wins Above Replacement (WAR) actually measures the on field performance of a player. This is most likely because it is relatively a new statistic that has only just started being mentioned in the past couple years. This statistic could be better than older statistics used by several other papers to determine how to measure a player's performance can affect a team's winning percentage. This paper will test to see how well WAR is in determining a team's win percentage and then use these results to look at demand for free agents.

The first step to solve this question would be to look at the available players on the free agent market and compare them to a team's current lineup to see how much of an increase in productivity there would be by signing the player. This will give a good understanding of which

players that will impact the teams the most. After that, determining what each team values the increase in productivity is and combining that with the increase in productivity will give a good approximation of the demand for the player for each team. Presuming the highest bidder will win the services, a team can then determine who is most likely sign the free agent and win their services.

Literature Review

The modern free agency system in baseball did not start until 1973, mostly because of a player named Curt Flood who brought his case eventually to the Supreme Court to get rid of the reverse clause. The reverse clause made it so that players were property of a team and forced players to be stuck with one team until they were traded or released. Even in the case of when a player was traded, the new team also had rights to do whatever they wished with the player. Even though the Supreme Court voted in a 5-3 decision to keep the reverse clause in 1971, a baseball arbitrator two years later threw out the reverse clause and starter the modern day free agency. (History.com)

A player can become an unrestricted free agent after six years of major league service on a team's forty man roster and does not have a contract. All players who meet this requirement become part of the free agent market after the last game of the World Series. (MLB.com) The free agent market is a special type of market since Major League quality baseball players are considered to be a rare find and no two baseball players are exactly the same. The best way to describe this market is more like an auction style since every player is unique. (Rockerbie) Since every player is different in skill level and position, a normal supply and demand model would not be correct in analyzing this market. In an auction style model, we would assume that the top player at his position would go first followed by the second rated player and so on. In this type of

market, teams place bids on players based on their evaluation of what a player is worth to their ball club.

The most debate on the subject of free agency comes on attempting to place this value on a player for each baseball team. Gerald W. Scully was one of the first to come up with a model to help determine the true worth of a player's production to a baseball team. The way Scully did this was to figure out the player's marginal (MRP). (Scully) The main variable that Scully used to evaluate a position player's value in 1974 was the statistic slugging percentage (SLG) which is a combination of batting average and power of a hitter. Scully then used strikeout to walk ratio (K/BB) to evaluate a pitcher's MRP to a team. The problem with slugging percentage is a good power hitter who hits a lot of homeruns and strikes out a lot could have a high slugging percentage but may not be desirable for a team because of the amount of strike outs. A pitcher can also have a bad strike out to walk ratio but still be a really good pitcher such as in the case with a "sinker ball" pitcher who relies on getting ground ball outs rather than striking out the batter.

One of the best research papers on determining the most important statistic for determining a team's winning percentage came from Adam Houser. Houser determined that for hitting, On-Base-Percentage (OBP) was the best offensive statistic and for pitchers it was Walks + Hits per Inning pitched (WHIP). Houser did not use variables such as stadium or if a team was in contention or not, which Scully used in his paper. Houser still leaves out some statistics that may play a role in determining a team's winning percentage such as defense. Even though Houser's paper is an improvement on Scully's analysis on what a player's true production to a team was, it still does not make it a perfect model for determining a team's win percentage.

While both OBP and WHIP are important measurements and are still used today to track

player performance, one statistic, WAR is considered the best single statistic today to evaluate a player's performance. WAR is a statistic created by sabermetric baseball community in the past few years to sum up all of a player's contributions into one statistic. (Fangraphs.com) While OBP only takes into account for hitting performance for a team; WAR takes into account speed, hitting, and defense. WAR takes into account all of these different aspects of the game by using OBS, based on the league average to calculate this hitting portion of the statistic to determine how well a hitter is. WAR then uses stolen bases based on league average stolen base, amount of double plays hit into, and position constant to calculate the speed and defensive portions. WAR for pitchers is also calculated similarly by looking at WHIP, what their home baseball park is, and the quality of defense the pitcher plays for. (Baseball-Refrence.com)

WAR is by far one of the most complicated statistics used to measure a player's performance in the game a baseball, which takes into account more than just one aspect of the game. The way WAR works is that a replacement player from the bench of a team, or a top minor leaguer, has on average a WAR of zero. What that means is that a player with a WAR of zero will not help his team win any extra games. A player with a WAR of 3.5 will help his team win an extra 3.5 games more than a replacement player with a WAR of zero. This statistic is in effect a player's marginal product (MP) because it measures the increase in a team's winning percentage. The generally agreed upon team winning percentage with a WAR of zero would have a winning percentage of .380. (fangraphs.com)

With a good understanding of how to measure a player's worth, it is important to figure out how a player's performance affects the free agent market. In Rockerbie's paper for deciding if the quantity of players at a position affects salary in the free agency market, Rockerbie breaks the players down by position. The one difference is that he groups all outfielders into one

category since all three positions are similar to play, and outfielders commonly move to different spots in the outfield. Rockerbie found that the supply of free agents at a specific position only increased the contracts offered slightly for catchers and short stops. All other positions besides short stop and catcher showed no significant change in salary base on the quantity of players available at that position in the free agent market. Since the supply of free agents only affected two positions slightly, the supply of free agents at a specific position in the free agency market will be ignored in this paper in determining the demand to help simplify the model. With a cleaner model, predictions will be easier to make predictions of the demand for the free agents.

There is also a lack of research done trying to determine demand for these players by teams in the free agent market. What makes one team value a player more than another team even though he has the same stats? Much research is done in determining a player's worth but not much in examining weaknesses of baseball teams and see how many teams might have the most interest for a certain player. Researchers seem to ignore the fact that teams do not have the same demand for players and some teams are willing to pay way more for certain players than others. The Oakland Athletics seem to be one of these teams that do not put a high value on an increased in performance with the 2nd lowest payroll rather than the Boston Red Sox's which finished last in their division, but still had the 3rd highest payroll in the MLB for the 2012 baseball season. Many researchers point out the fact that their marginal revenues (MR) are different which then in turn causes the amount they spend on salaries to be different.

One issue that will not be addressed in this paper is calculating MR for the ball clubs like done in papers such as Scully's, but rather using data on existing salaries and determining a player's MRP rather than data from revenues. Data on revenues of baseball clubs is very weak based on ticket sales and revenue sharing and it may be difficult to tell the true revenue of a

team. Today, baseball clubs are planning TV deals that have a worth as much as $4 billion dollars. (Bloomberg.com) This information is available to clubs in private but not necessarily to the public, which may make it difficult to derive a team's true MR. Instead, it is presumed that clubs have more information and offer contracts based on their knowledge of what their true MR is. Salaries of current players should give more information on what a team's true MR is.

A question looked at in many research papers is what stops wealthy teams from buying all the top free agents since there is no salary cap. This was not an issue back when the reverse clause was in effect because, because a team can hold onto talent for as long as they want. A research paper called "Implications of the Auction Mechanism in Baseball's Free Agent Draft", written by James Cassing and Richard Douglas, finds that players still tend to sign contracts with bad teams because "a player is most valuable at the margin to a team with the least amount of talent." This means that a team with a poor player, production wise (in this study WAR will be the measure), at a specific position will have a greater benefit of signing the free agent than presumably a wealthy team with already good talent at the position. This gives more incentive for weaker teams to sign talented free agents than already successful teams since their Marginal Benefit (MB) is higher.

Using data from the 2012 season from baseball_refrence.com, the most desired free agents can be determined from subtracting the current war of the team by position from the free agents. Once the amount of WAR increase is determined, groups can determined on how much teams are willing to spend per war increase based on their 2012 salaries. Using this data together, the amount a team is willing to offer a free agent can then be determined.

Economic Model

For this paper, all of the statistics will use data from the 2012 season to calculate WAR. This paper will also use current rosters as of November 15th 2011 to help decide where a team's weaknesses are. Free agents also as of November 15th 2012 were the only free agents considered in this paper. A projected lineup for the 2013 season takes the highest WAR at each position for each team to assemble the projected lineup since these should be the best players on a team. Finally, this paper only chooses to look at the best pitcher for a team instead of using data from all the pitchers on a team's rotation.

To be able to make a decision on which free agent would make a best fit for a team based on an increase in WAR, we must assume that increase in WAR is also relates to an increase in a team's winning percentage. In Houser's paper, he found that OBP and WHIP was the best two statistics to best predict team, but left out the statistic WAR. Since WAR is a combination of OBS, WHIP, and several other defensive statistics and is also widely used by experts in the baseball field as the single best statistic to evaluate a player's overall performance, we will assume that an increase in war is directly related to an increase in a team's win percentage. Another assumption made will be that there are different groups of teams that value the addition of one more win differently. Some teams have payrolls four times more than other ball clubs, so we can expect that there is a difference in value based on an increase in one win versus another team.

One more assumption that will be used for this model is that a team's main focus in the free agency market will be to improve their starting lineup. The players who spend the most time on the field of play will have a greater affect than a backup player who is only on the team to give a player a rest or to fill in in case of an injury. Thus, a team will want to fix their starting

lineup before they work on their fill-in players. It is also true that teams may also want to upgrade their bench players too, but this will not be addressed in this player since bench players do no play as major as a role to a team's winning percentage as starters.

To figure out how much a team values an increase in one win, the assumption will be made that owner's think that payroll is related to how well a team does. If payroll did not have an effect, there would be no reason for teams to have a bidding war for certain players. This is based on the idea that a team with a smaller payroll should not expect to win as many games as a team with a larger payroll. An owner spending more money on salaries has a higher value for a win. A regression can be run based on a team's payroll to help determine the team's value of an increase in one win.

With these assumptions, the first step will be to test how a team's total WAR for the starting lineup relates to a team's winning percentage. By running a regression on a team's total WAR for the starting lineup, the regression will produce the marginal benefit of an increase in one WAR to a team's winning percentage. Then, how much a team values an increase in war can be calculated by first grouping the teams with a cluster analysis based on their payroll for their starters to group teams with similar spending habits. Then dummy variables can be assigned to these groups and a regression can be run with these dummy variables on team's starting payroll to get what the average pay was for a starter in each group.

With the knowledge of what a team paid for to achieve their 2012 win percentage, a simple equation can be used to calculate how much value they would have placed to have the free agent versus a current starter the team currently has. By finding the difference in war from the free agent and the current starter, then multiplying it by the coefficient for the spending group a team is in, an estimated demand for the free agent for each team can be calculated. Once this

demand is calculated, teams can be projected based on each team getting one of the top free agents based on the highest demand first and then the second highest demand and so on.

Empirical Analysis

For this report, total war of the starter's was the only variable used to calculate a team's winning percentage. The regression equation used to estimate a team's win percentage was:

$$TWP = \beta_0 + \beta_1 TTW + \varepsilon$$

Where:

TWP = Team's winning Percentage
TTW = Team's total WAR
ε = Random Disturbance term

The regression equation used to estimate a team's payroll for a starter in this report is:

$$TALS = \alpha_0 + \alpha_1 SL_1 + \alpha_2 SL_2 + \alpha_3 SL_3 + \varepsilon$$

Where:

TALS= the teams average lineup salary
SL = Dummy variable for spending level
ε = Random Disturbance term

The equation use to calculate a team's demand for a specific free agent would be:

$$TD = \alpha^* * (WAR_{FA} - WAR_1)$$

Where:

TD = A team's demand for a the specific player
α^* = The coefficient for the team's spending level
WAR_{FA} = WAR statistic for the Free Agent
WAR_1 = WAR statistic for the current position based on the project starter at the position for the team.

To test how well war predicts a team winning percentage, a regression using a team's total war can be used to predict a team's winning percentage. Since WAR is supposed to be

directly related to a team's winning percentage, we would expect the intercept to be equal to .380 since a team with a total WAR = 0, which would be a team full of replacement players, was the agreed value for a winning percentage for a team. We should also expect the intercept of a team's total war to be .0123 since an extra win would be equal to a .0123 increase in win percentage out of a 162 game season. Running a regression we get results shown in Table 1:

Winning Percentage Regression

TWP = Team Winning Percentage
TTW = Team Total War
ε = Random Disturbance term

(p-values in parentheses)

$$TWP = .4234 + .01429\ TTW + \varepsilon$$
$$(<.0001)^* \quad (.0187)^*$$

Standard Error = 0.02858
Adjusted R^2 = 15.29%
F-Statistic = 6.23
DF = 29

* Indicates significance at the 5% level

As it turns out, WAR does prove to be a significant predictor of a team's winning percentage with a p-value of .0187. It also turns out that the intercept and the coefficient for team's total war is not as expected. While the coefficient for a team's winning percentage seems to be close, but the intercept seems to be significantly different than what was predicted. With an intercept of .4234, it is .0434 more percentage win points than predicted which translates into 2.32 extra wins in the 2012 season than what was the general agreed upon from the research. This does not seem to be a lot though when looking at a 162 game season. Looking at the distribution of war by position for the 2012 season might point out some explanation of the results obtained from the regression.

Table 1 shows the distribution of WAR by position for the 2012 season. The average war for the 2012 season appears to be less than zero for almost every position, even though it would be expected WAR to be slightly above zero. This would explain the higher intercept and the higher coefficient for WAR since the average player performed worse than the expected average of zero which means replacement players would be able to win more games. With these results it would be safe to continue on and say that WAR is good evaluation of a player's MP.

The next step to determine the how much demand a team might have for a particular player will be to look at a team's spending habits. This hopefully will give insight on what a team truly values an increase in WAR which is their MRP. Teams will be categorized by their spending on salary for the 2012 season. To do this, a cluster analysis will be done to determine several different categories of spending based on their 2012 salaries for their 25 man roster. By doing a cluster analysis on the teams, we can find common spending habits from these teams. It is difficult to describe spending habits of a particular team but by grouping teams together with similar spending habits it will give a more general view on how much they spend for players. Once the appropriate number of groups is decided and each team is assigned to a group, this data can then be used to determine what each team values an increase of WAR is.

Based on the Cluster Analysis Dendrogram, the cluster analysis shows that using four spending categories would be a good way to categorize the spending habits of the 30 major league clubs. This means that there are four different groups where teams have similar spending habits based on their 2012 salary. Dummy variables can then be assigned base on their spending habits ($SL_1 - SL_4$). SL_1 will represent the highest spending level while SL_4 will represent the lowest spending level. With this data, a regression can be run using the spending level dummy variables to determine total war of the rosters for the top players in the 2012 season.

Starter Payroll Regression

TALS = Team Average Starting Payroll
SL = Dummy variable for spending level
ε = Random Disturbance term

(p-values in parentheses)

$$TALS = \underset{(<.0001)^*}{3{,}329{,}443} + \underset{(<.0001)^*}{12{,}786{,}474}\, SL_1 + \underset{(<.0001)^*}{6{,}644124}\, SL_2 + \underset{(<.0001)^*}{2{,}832{,}659} SL_3 + \varepsilon$$

Standard Error = 2.7009
Adjusted R^2 = 93.80%
F-Statistic = 147.17
DF = 27

* Indicates significance at the 5% level

With this regression, the spending level dummy variable can be given a coefficient that represents how much a team is willing to pay for a starter. The intercept of α_0 represents the spending level of lowest spending group for war in the 2012 season while the coefficients of the other groups represent how much more the other spending groups spent per WAR an increase in war than the lowest group. The intercept plus the coefficient for the dummy variable is the amount a team values an increase in win.

The next step would be to figure out how much each free agent can increase war by if they were to be added to a certain team's roster. Based on a team's projected 2013 starting lineup, the amount of increase in WAR can be calculated for each position based on the free agent. Then, the value of the increase can then be multiplied by the team's spending level coefficient. This number will represent a team's demand for the specific free agent which can be used to determine a free agent's MPR to the team. The multiplication of coefficient represents how much the team values that increase in WAR.

By using this equation, we can find the MRP for the free agent for a specific team. This does not mean that this is how much a that a team will offer a contract, but rather the increase in

expected value increase that the team would have received in having the player over their current position player if both the current position player and the free agent were to put up the same numbers in 2013 as they did in 2012. Table 2 lists the demand for Michael Bourn, the top center fielder free agent based on war, by team.

From this table, we see that the Boston Red Sox's had the highest Demand for Bourn. This is because their current center fielder had a war of .02 and Boston had a high value for the increase in the value for an increase in WAR. As mentioned by Cassing and Douglass, the highest demanding team is not from the highest spending group since these teams already had good centerfielders. Though some teams may have had worse centerfielders than Boston, their value of an increase in WAR was larger causing them to have the highest demand for Bourn. It is also important to note that teams such as the Los Angles Angels do not have negative demand for Michael Bourn, but rather prefer to have their current centerfielder, Mike Trout, more. This could also be done for any free agent that is available which can give a general manager valuable information when putting together a competitive team.

Because a wealthy team will not get all of the top free agents, it can be assumed that every team has a chance to sign one of the top 30 free agents even though this is not a guarantee. (Cassing & Douglass) It is possible to generate a possible list of probable destinations based on the demand estimated for them. Table 2 shows the data generated from this data.

Table 3 shows the projected destinations of the top 30 free agents base on the assumptions set in place. It is important to notice that for teams do not have negative demand for certain players at the bottom of the table, but they just prefer to have their current starter over the best free agent that was still available. As predicted by our formula and Cassing & Douglass, even though some of the wealthy team's take a few of the top players, there are some teams such

as the Miami Marlins who are still able to jump above the top spending teams such as the New York Yankees in demand for a free agent. It is also important to note that the demand is not salaries that would be offered but just a measurement of the value of the increase in production for the team. Several other factors would be taken into account that would affect the contract offered.

Conclusion

The purpose of this paper was to find a good way to solve for each of the thirty teams demand for a specific free agent. In the process of solving this problem, it was found that WAR by itself was a good way to evaluate a player's MB for a team. Maybe better than both Scully's or Houser's method for evaluating since it is the only variable used to evaluate how a player affects a team's winning percentage and does not include other variables. It also does not include variables like league or if a team was in contention or not to predict a team's winning percentage which is something a player cannot control.

By using the MB of the player with what teams paid for an extra war, a good understanding of what demand there was for each free agent from each team. With this data, a general manager could presumably decide if he wanted to increase his value of WAR to sign the free agent, and how much the increase would have to be based on other team's interests. This model could also be used to figure out the effects of a trade with a few small changes.

Another main purpose of this paper was to successfully predict the locations of where these free agents end up. To date, Juan Pierre signed a contract with the Miami Marlins on November 18th for 1.8 million dollars. (ESPN.com) Juan Pierre going to the Marlins based on his MB and the teams MR is exactly what this model predicts in this paper. Most of the other free agents are still to sign a contract with a team.

A good follow-up study would be to see how successful this model is in predicting the end locations of these free agents. It would be good to see the top 3 or 5 demanders for a player and see if the free agent actually ends up with one of those teams. If a free agent does end up with one of those teams it could be considered a successful prediction, but if the free agent did not it would be considered not successful. By evaluating how successful this model is, changes can then be studied later to make the model more successful.

Of course, there are many other factors that may contribute to the demand of a free agent that was not tested in this paper. This paper only used the previous year (2012) as the basis of demand for the free agent. This would most likely be one of the most important factors in determining demand for a free agent, but age and other variables may also play a crucial role. Most notably the top left fielder in this study, Melky Cabrera, tested positive for steroids in the 2012 and served a 50 game suspension. (Mitchell) This will almost certainly drive down the demand for him, no matter how good his 2012 season was. More exploration is need on other factors that may influence a team's demand such as age of a player, injury history, and off field issues may all be factors that influence a team's demand which like the value for MR may be significantly different for certain teams. A team may choose to pursue a free agent who had a worse 2012 season than a free agent who is at the end of his career and has had a history of injury problems since there might be more risk with this player.

Another point that can be expanded on in this paper is the analysis of a team's demand for pitchers. A true team needs five quality pitchers in the rotation usually to successfully make it through the season. This paper only looks at the quality of the best pitcher on each team versus the free agents and does not look into the quality of the other four pitchers in the rotation. It would be important to look at the quality of the other four pitchers since the other four pitchers

usually pitch just as many games as the Ace of the team. Some teams may want to focus on improving these positions which is not covered in this model.

Another point in this paper that could have been adjusted is grouping all three outfielders into one category since it is easy for one outfielder to shift from left, center, or right since each position is very similar defensively. Some teams may choose to sign a talented hitting outfielder and choose to move him to another spot in the outfield to get more production. This could also have an effect on demand which is not included in this paper.

This study could also be used on other professional sports to study demand for free agents in their respective free agent markets. Other sports may have different rules on free agency which are not as wide open as baseball, so some adjustments may have to be made. WAR is also a variable only specific to baseball and there might not be another statistic equivalent to this in another sport so other variables may have to be used to evaluate a player's MP.

Appendix A

Regression 1

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: TWP

Number of Observations Read	30
Number of Observations Used	30

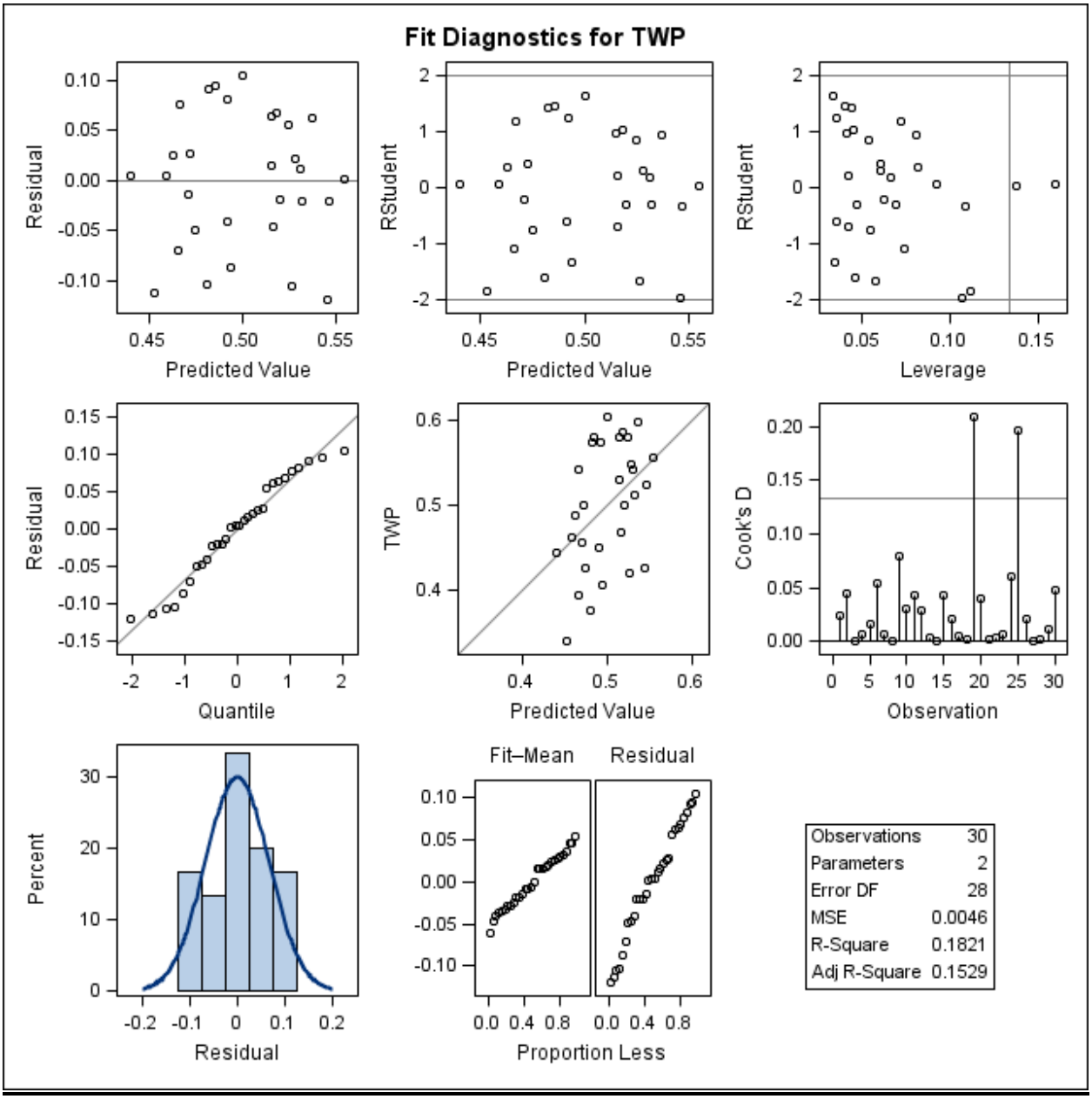
Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	0.02858	0.02858	6.23	0.0187
Error	28	0.12837	0.00458		
Corrected Total	29	0.15695			

Root MSE	0.06771	**R-Square**	0.1821
Dependent Mean	0.50000	**Adj R-Sq**	0.1529
Coeff Var	13.54213		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	0.42340	0.03308	12.80	<.0001
Totalwar	1	0.01429	0.00572	2.50	0.0187

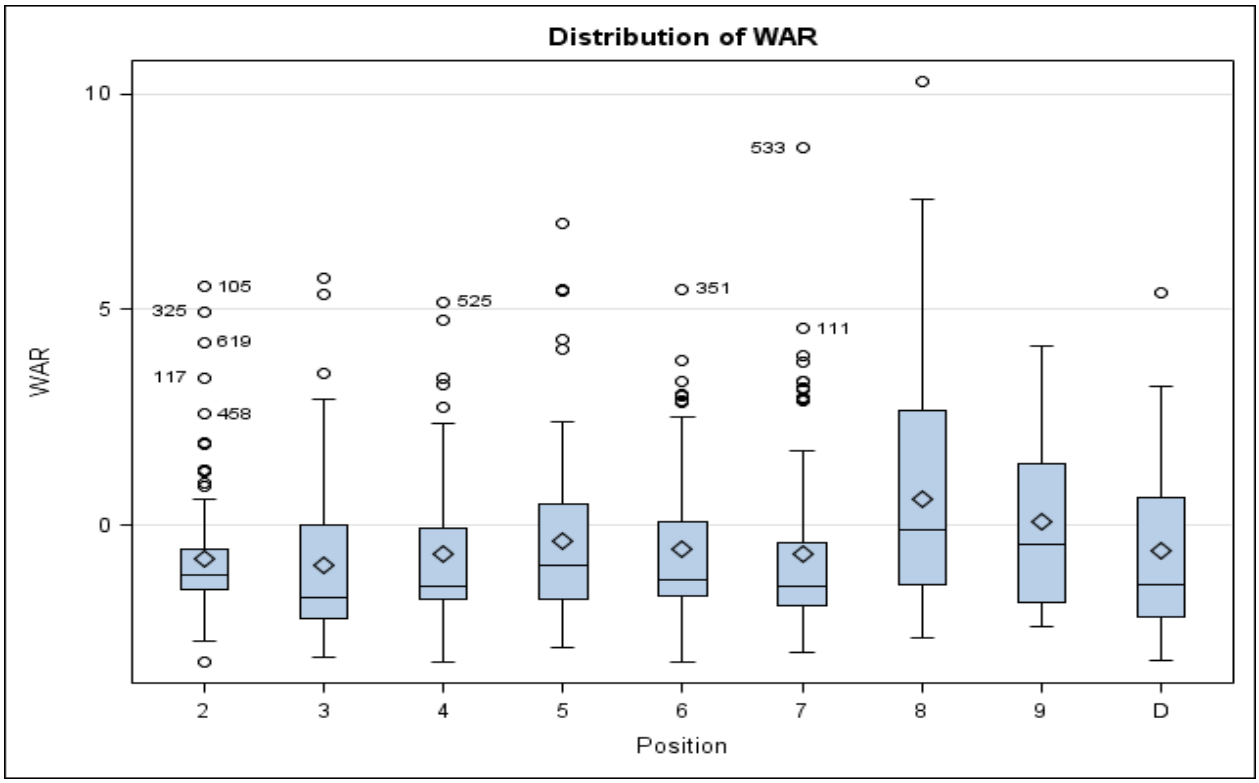
*Regression output from SAS on team win percentage using total starter WAR.

Residual Analysis 1



*Residual plots from regression 1

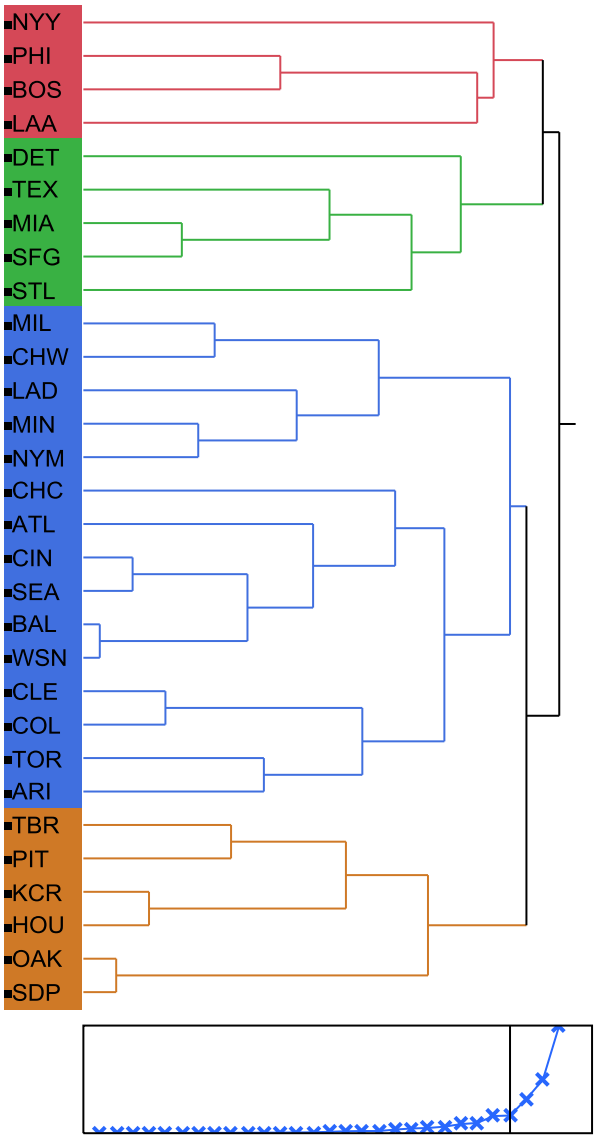
Table 1



**This graph shows the distribution of war by each position including outliers for the 2012 season.*

Cluster Analysis Dendrogram

Dendrogram of 2012 payrolls by Team



*Produced using JMP

Regression 2

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: Starter Payroll

Number of Observations Read	30
Number of Observations Used	30

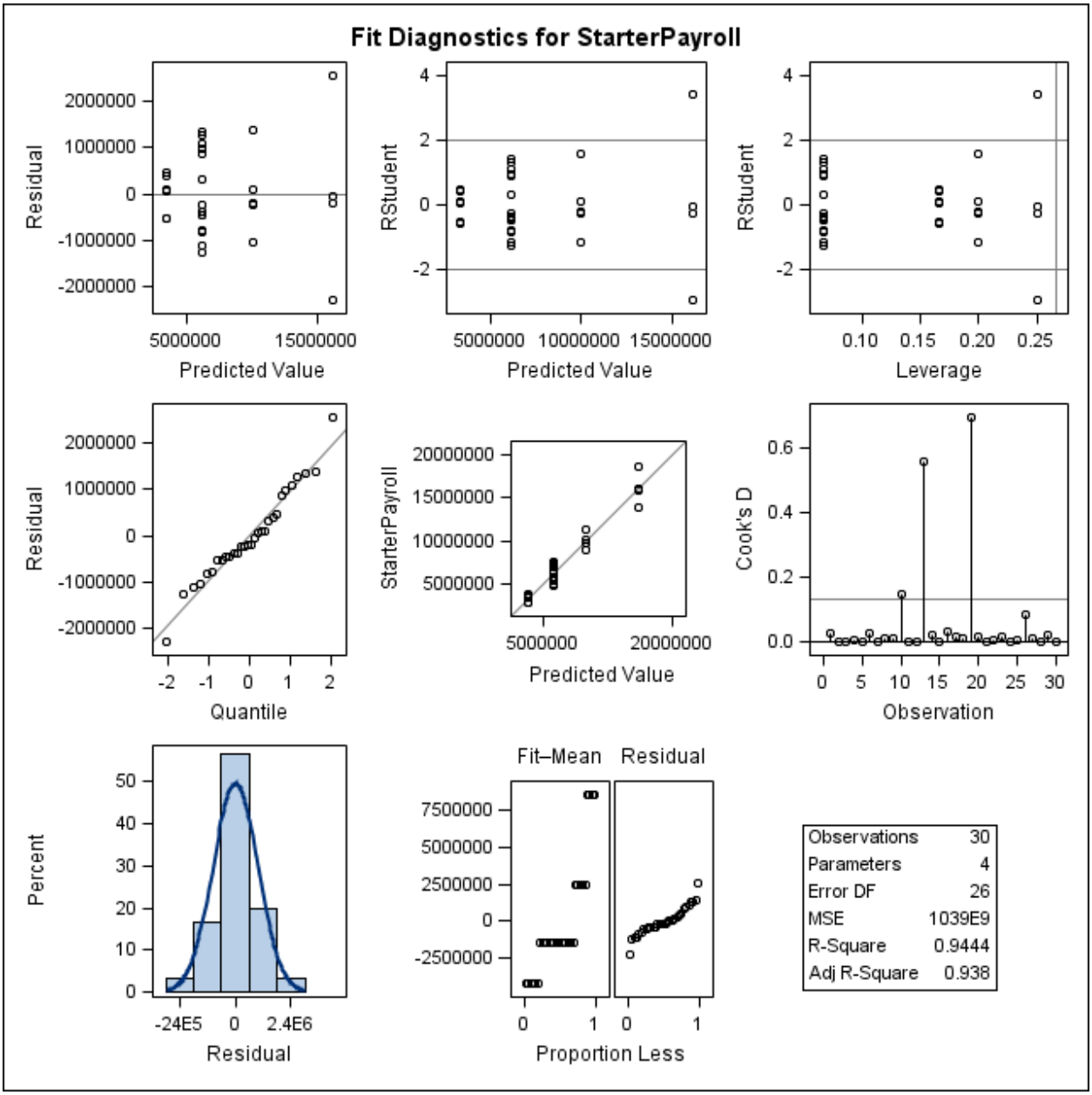
Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	3	4.586387E14	1.528796E14	147.17	<.0001
Error	26	2.700886E13	1.038802E12		
Corrected Total	29	4.856476E14			

Root MSE	1019216	**R-Square**	0.9444
Dependent Mean	7557990	**Adj R-Sq**	0.9380
Coeff Var	13.48529		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	3329443	416093	8.00	<.0001
SL1	1	12786474	657901	19.44	<.0001
SL2	1	6644124	617166	10.77	<.0001
SL3	1	2832659	492328	5.75	<.0001

*Regression output from SAS on a team's starting payroll based on spending level.

Regression Analysis 2



*Residual plots from regression 2

Appendix B

Table 2

Demand for Free Agent Michael Bourn
By Team

Team	Demand
BOS	74,386,243
NYY	38,606,572
TEX	37,049,207
TOR	36,930,224
NYM	29,569,671
CIN	29,297,710
ATL	27,439,819
ARI	22,935,622
CHC	21,234,513
MIA	19,670,581
STL	19,528,842
SEA	19,500,011
CLE	18,887,649
MIN	18,357,196
HOU	14,638,963
SDP	13,348,837
KCR	10,604,750
CHW	9,568,499
LAD	9,539,279
WSN	9,001,781
MIL	8,099,124
DET	6,262,964
COL	5,623,093
BAL	5,455,421
OAK	3,540,456
PIT	-9,649,202
LAA	-90,963,045

*Created using SAS

Table 3 ***Projected Free Agents***

Free Agent Name	Position	Team	Demand
Melky Cabrera	7	PHI	84,196,778
Adam LaRoche	3	BOS	58,287,282
David Ortiz	D	LAA	52,745,687
Juan Pierre	7	MIA	43,599,355
A.J. Pierzynski	2	NYY	37,397,706
Michael Bourn	8	NYM	29,569,671
Josh Hamilton	8	CIN	29,088,409
Kyle Lohse	1	COL	27,329,728
Jonny Gomes	D	TEX	25,881,028
Marco Scutaro	4	STL	24,180,717
Jeff Keppinger	5	CHW	19,166,944
Angel Pagan	8	ARI	17,671,205
Eric Chavez	5	CHC	12,897,667
Carlos Lee	3	SEA	9,783,701
Mike Napoli	2	SDP	8,099,949
Maicer Izturis	5	ATL	7,996,622
Edwin Maysonet	6	BAL	6,445,248
Lance Berkman	3	CLE	5,283,960
Russell Martin	2	TBR	3,911,248
Kevin Youkilis	5	OAK	3,082,285
Kelly Johnson	4	LAD	2,068,762
Alberto Gonzalez	6	SFG	1,373,917
Carlos Pena	3	WSN	683,945
David Ross	2	HOU	413,539
Jeremy Guthrie	1	TOR	397,258
Kelly Shoppach	2	PIT	-494,298
Randy Wolf	1	KCR	-2,789,633
Gerald Laird	2	DET	-11449607
Dioner Navarro	2	MIL	-17594497
Luke Carlin	2	MIN	-36769461

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