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Evaluating the Changing Competitive Landscape of Major League Baseball: The Eye Test.

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EVALUATING THE CHANGING COMPETITIVE LANDSCAPE OF MAJOR LEAGUE BASEBALL: THE EYE TEST.

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Abstract

Americans oldest past time, baseball, has turned into a multi- billion dollar industry under Major League Baseball alone. Baseball is an entertainment industry that is driven by putting a profitable, entertaining, and competitive product on the field to draw the fans to the games or televisions. However, in the late 90's, claims of a lack of competitive balance due to large market team spending became loud and widespread. An uncompetitive and unentertaining product would clearly cut into the profits of Major League Baseball. This was a fact that Bud Selig was well aware of when he commissioned the Blue Ribbon Panel, a panel of experts, to evaluate these claims in 2000. The Blue Ribbon Panel concluded that the claims of a growing lack of competitive balance due to large market spending were correct. This conclusion lead Bud Selig to revamp the revenue sharing and luxury tax structure of the league to put a more well balanced product on the field. However, the Blue Ribbon Panel largely used wins to measure competitive play. Wins, being a binary statistic, prevented a truly precise comparison between the teams of the league to be made. This study aims to learn the story left untold by the Blue Ribbon Panel and other academic studies of the 1990's by creating a measure of team strength based on the gambling markets perception of competitive play. After all, human perception of competitive play is what the industry should be most concerned about. Using this newly created measure of competitive play, this study observed a change in competitive balance, but could not definitively link this change in competitive play with a growth in large market team spending.

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1. Introduction

Drugs, unemployment, and income gap disparity sound like topics to be covered in a current political debate, but also aptly describes Major League Baseball (MLB) in the 1990s. Memories of Sammy Sosa and Mark McGwire homerun trots overshadow the on-the-field success of the New York Yankees and Atlanta Braves. Unfortunately, memories of Mark McGwire standing in front of his locker being questioned about his use of steroids and the subsequent concern of the use of steroids in professional sports are remembered soon after. It was also the home of the only strike in American sports history that caused the cancelation of an entire post season**.** Even with all this drama surrounding the game, an age old political hotbed issue of the haves and have nots leaked its way into baseball. The league was starting to lack competitive balance with the big market teams seemingly outspending the small market teams to the point the small market teams simply couldn't compete on the field. Baseball is a marketplace that is relatively unaffected by outside factors. Evaluating the effect of team spending in such a market place is of particular interest to an economist and will be the subject of this paper.

In a traditional marketplace, firms compete with one another. Major League Baseball differs in this aspect as it is more of a joint venture between 30 distinct firms. The league can be seen as a joint venture because of the nature of the product being sold. A marketable baseball game requires two teams to play and for both teams to be competitive enough that fans will have an interest in watching the game. These two

requirements give each team an interest in ensuring its competitors are profitable enough to put together a competitive product on the field.

Further strengthening the joint venture aspect of Major League Baseball is the rather protected market share each team enjoys from their geographic location and the inability for firms to freely encroach on their geographic location. This negates much of the need to drive competitors out of business. In fact, baseball teams have long been divided into two groups based on their set geographic market: big market and small market teams. The division of teams based on market size naturally arises in the sport, as observed by the Blue Ribbon Panel, an average of 79% of team revenue comes from local revenue sources (Levin et al.). The significance of teams deriving most of their revenue from local revenue sources is highlighted when the size of the natural local markets are taken into account. For example, in 1999 the Yankee's local revenue was $176 Million. This figure dwarfed the poorest team in the league, the Expos, who only had a meager $12 million in local revenue (Levin et al.**)**. Logically, higher revenue leads to a higher ability to reinvest into the team payroll. This can be seen with the corresponding drastic gap in payrolls with the Yankees spending $88 million compared to the Expos spending a mere $16 million (USA News). While some of the gap in local revenue could possibly be explained by the struggles of the Expos vs. the Yankees' wild success, the effect of being located in a large market cannot be discounted as seen by the Los Angeles Dodgers with large local revenue of over $100 million despite having a losing record. (Levin et. al.)

Teams cannot freely choose their own location or else a clustering of teams around a few big markets would likely occur. This creates a sizeable advantage that some teams naturally have over others and a reason of concern for supporters of a level playing field. On face value, Bud Selig and Major League Baseball did have reason to listen to the fans' complaints about the big market issue. In the latter part of the 1990's, the New York Yankees won 4 of 5 world championships. Perhaps, not coincidently, during this same half of the decade the team payroll and revenue disparities were reaching all time highs. Watching the New York Yankees increasingly put more money into the their teams payroll and the corresponding on the field success that appeared to produce, it is obvious why fans were concerned over the state of the league.

The perception of the fans about the diminishing level of competitive balance of the league was shared by a report created by a Blue Ribbon Panel. This report, to be discussed later in the paper, stated the large market teams were gaining a growing advantage in the post strike years of the decade in the form of larger revenues and in turn team payrolls. The report argued this trend was affecting the ability of the smaller market teams to put competitive teams on the field with the large market teams buying a disproportionate amount of the talent. The study suggested this was of alarming importance due to the idea that Major League Baseball teams were not selling 30 individual products, but one combined product. This idea of one common product would necessitate a need for reform on the financial side of the league to correct the imbalance on the playing field**.** In fact, this thought process prompted Major League Baseball to evaluate tools to put into place to ensure that the ability to put together a competitive

team was not overly determined by market size**.** With the natural disadvantage faced by small market teams, competitive balance promoting measures such as a luxury tax and revenue sharing were championed by supporters of a more competitively balanced league.

After the Blue Ribbon Panel's report, a new revamped revenue sharing system was installed in 2000 and a new luxury tax system was put in place in 2003. On face value, these two tools used to promote competitive balance seem to have worked. Since the 2001 MLB season, nine different teams have won a world series in eleven seasons. This is a stark contrast to the Yankee-dominated late 1990s. Additionally, since the installation of both tools, revenue and payroll disparities have narrowed. Based on the casual observation of the seemingly increased competitive balance of the league in the 2000s with the decreased gap in team payrolls, a conclusion could be drawn that the driving force behind competitive imbalance of the league was in fact the disparity of payrolls. Whether this conclusion can be supported by more concrete evidence will be examined in this paper.

Evaluating traditional statistics used in the Blue Ribbon Panel report such as wins and playoff success, the story behind the seemingly growing lack of competitive play in baseball seems clear cut. Large payroll disparities were leading to large disparities in the quality of teams' play on the field. However, these more traditional statistics are not without their flaws when it comes to measuring competitive balance. A win or a loss simply shows the result of the game; however, it does not tell how competitive the game

actually was. Finding a way to measure competitive play may seem impossible, as it is essentially trying to find a way to measure a fans perception of what competitive play is.

Fortunately, a past time that is as old and as popular as baseball itself, offers a unique way to measure the fans' perception of competitive play. Gambling on competitive events is an age-old pastime that has evolved into a large market . In 2007, legal bookmaking grossed over $168 million the United States alone (American Gaming Association). The usefulness of betting lines in measuring competitive play is obvious, as betting lines offer a way to turn human perception of the competitive ability of a team into a quantifiable number. Gamblers watch the baseball games and are able to get a firsthand insight on the true ability of the teams playing. This insight is then used to predict the outcome of future games. Betting lines differ from win-loss statistics as the lines are not a binary statistic. The lines show what team is perceived as better and to what degree.

This paper tackles the question of whether big market spending is affecting the competitive balance of Major League Baseball through the use of betting lines and a pricing model adopted from a paper written by Raymond Sauer in 1993. Section II of this paper presents a review of previous literature on measuring the competitive balance in baseball. Section III illustrates the usefulness and validity of using betting lines to measure competitive balance with the help of previous literature on the subject. In Section IV, I introduce and review both the statistics used in this paper and the pricing

model used to test them. Section V and VI breaks down the results of the pricing model test and the conclusion of the paper, respectively.

2.Literature Review

2.1 Previous Studies of Competitive Balance in MLB

After the 1994 strike and the following five years of Yankee domination, Bud Selig commissioned a Blue Ribbon Panel to examine the declining level of the competitive balance in Major League Baseball. Using wins, playoff appearances, playoff wins, revenue, and payroll as the study's main criteria**,** the Blue Ribbon Panel set off to explore the effect the growing payroll and revenue disparities were having on the competitive balance of the league. The study came to a strong conclusion in support of the idea that payroll and revenue disparities were the primary culprits causing the lack of competitiveness from the small market teams. This conclusion led the Blue Ribbon Panel to recommend that each team put forty to fifty percent of its local revenue into a combined pool controlled by the league.

To analyze the relationship between competitive balance and payroll disparities during 1995-1999, the study split the league into four quartiles ranked by payroll for each year examined and then compared how successful each quartile was in terms of wins and playoff success. Using these criteria to measure the competitive balance of the league, it is no wonder the study came to such strong recommendations as the results were shocking.

Table 1- Blue Ribbon Panel's Results

	Quartile 1		Quartile 2		Quartile 3		Quartile 4	
	Avg. payroll	% Playoff	Avg. payroll	% Playoff	Avg. payroll	% Playoff	Avg. payroll	% Playoff
1995	$46.40	80.6	$36.90	19.4	$31.40	0	$17.80	0
1996	50	78	37.9	22	28.1	0	18.2	0
1997	57.4	97	45.3	3	35.4	0	21.5	0
1998	64	73	50.1	27	35.4	0	18	0
1999	78.8	94	55.7	6	41	0	20.2	0
Avg.		84.52		15.48		0		0

* **League is divided into 4 quartiles, ranked by payroll with Quartile 1 being the highest**

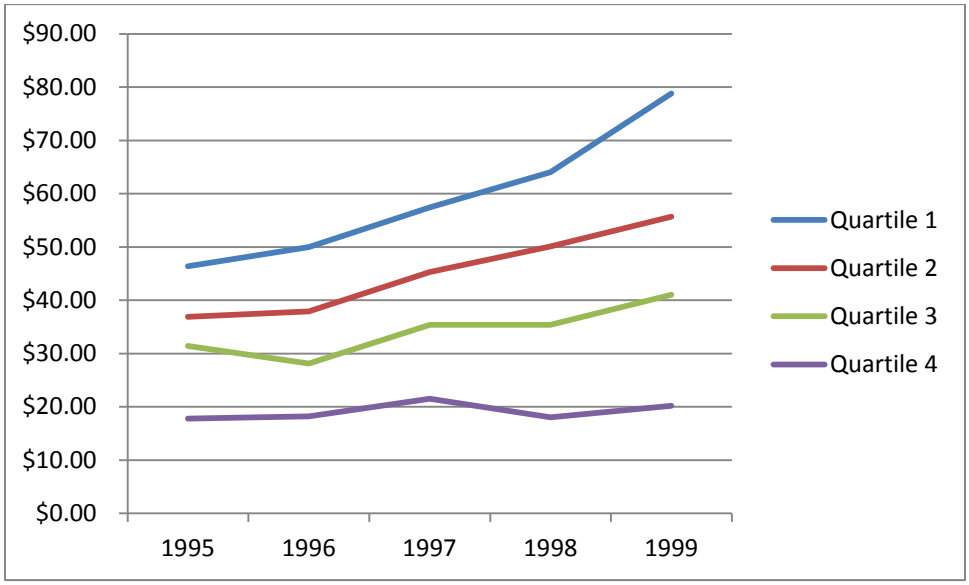
***Data obtained from the Blue Ribbon Panel (Levin, Mitchel, Volcker, Will)**

As observed from the table above, teams in the top payroll quartile won over 84% of the playoff games that took place in the following five seasons. This is a stark contrast to the teams in the bottom two quartiles who won zero playoff games in those five years! Teams in the 2nd quartile did not fare much better as only one team from the second quartile made the World Series during this time period. Teams in Quartile 1

clearly had a stranglehold on post season success. The question that follows is, what caused Quartile 1 teams to be undeniably head and shoulders above the rest of the league?

Looking at the graph below, it is quite obvious how one could be drawn to the conclusion that the driving force of Quartile 1's dominance during this era was the growing payroll disparity. During the time period evaluated in the study, the average payroll of Quartile 1 teams increased by $28 million. This amount was seven times larger than the $4 million increase in payroll seen by Quartile 4 teams. Coincidently, the total revenue of Quartile 1 teams had a 71% higher growth rate than the Quartile 4 teams. Superficially, a link can be drawn between the differing growth rates amongst the Quartiles and their respective success on the field.

Figure 1-Payroll Growth of the late 90's



The Blue Ribbon Panel identified local revenue as the main culprit for the growing disparity. Local revenue accounts for the majority of a team's overall revenue, giving larger market teams a natural advantage on being able to invest more in the team via payroll. The study's conclusion falls in line with the growing popular sentiment that small market teams were at a natural disadvantage.

Seven years after the Blue Ribbon Panel report, Elanjian and Pachamanova(2009) investigated how much the competitive balance had changed in the league in recent years. Dividing the teams into quartiles, Elanjian and Pachamanova compared payroll, revenue, and wins for the years following the Blue Ribbon Panel (2000-2007) to evaluate the effect the current revenue sharing system has had on baseball. During the time period evaluated, the study found that the revenue and payroll gaps amongst the Quartiles had diminished in the 2000s. To illustrate this in more detail, Quartile 1's payroll in the 1995-1999 post-strike years grew at a staggering 10.42 percent, a figure that dwarfed Quartile 4's 1.75 percent growth. The opposite happened in the 2000s where the growth rates had practically reversed, with Quartile 4 experiencing a 5.86% average growth compared to quartile 1's 1.14%.

Despite the significant progress made in closing the payroll and revenue gaps, only minor progress was made in improving the regular season success of the teams. To evaluate this phenomenon further, the authors ran a simple regression on payroll's effect on winning percentage. This simple regression was run separately for the late 90s and the 2000s to determine if payroll's effect on competitive play had changed between the two

time frames. As evident by the small progress in competitive play despite the large progress on payroll disparities, the regression showed that payroll had a much smaller effect on winning percentage in the 2000s. Looking at the table below taken from the paper, payroll's effect on winning percentages had shrunk to almost one third of what it was in the late '90s.

Table 2- Study on Revenue Sharing Results

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	39.83590976	1.168215	34.0998	2.87E-70	37.5265691	42.14525042
Payroll	0.253575513	0.026859	9.440924	1.01E-16	0.200479987	0.306671039
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	43.49747832	1.201438	36.2045	9.00E-99	41.13066681	45.86428983
Payroll	0.08384466	0.014401	5.821975	1.87E-08	0.055474143	0.112215176

Table 2. Regression results for the relationship between payroll expense and percentage wins during the regular season: 1995-1999 (top); 2000-2007 (bottom).

However, these studies, similar to the media's perception, assumed market size was the problem and then set off to gather evidence to support this initial assumption. This idea was put to the test by a response to the Blue Ribbon Panel report that questioned whether market size was really the driving factor in the lack of competitive balance. "*Competitive Balance and Market Size in Major League Baseball: a Response to Baseball's Blue Ribbon Panel"* set out to define market size and then show the effect that factors correlated to market size had on winning percentage.

When market size was defined by population and per capita income, Schmidt and Berry(2001) found little correlation between market size and on the field success. For example, Cleveland experienced great success in the late '90s when the large market teams were said to have gained a massive competitive advantage. Considering Cleveland ranks 20th as a Metropolitan Statistical Area, this is quite contrary to what would be expected. Additionally, Boston ranked 10th as a MSA and showed miserable results on the field. In fact, on a quick glance, the authors found little correlation between MSA

measures such as per capita income and population and on-the-field success measured by winning percentage.

Taking an alternative view on the definition of market size, Schmidt and Berri(2001) turned to revenue and payroll measures, which are how the Blue Ribbon Panel defined market size. To further explore this relationship of market size and success on the field, Schmidt and Berri(2001) used the statistical measure of a Gini coefficient to show how evenly wins were distributed across the league**.** The Gini coefficients were with ranked by their relationship to various exogenous factors and endogenous factors. Doing this allowed the authors to examine how endogenous and exogenous factors were affecting the competitive balance of the league.

Schmidt and Berri did find some correlation between endogenous factors and success on the field. However, the interesting aspect here is that this correlation was not found to be consistent and only seemed to last for brief periods of time. Citing the failures of the big spending Los Angeles Dodgers and Baltimore Orioles, the authors hypothesized that market size no matter how it was defined is not the driving force behind success on the field. Rather, the quality of the team's front office and management dictated the quality of the product produced on the field. Furthermore, they bring up an interesting point on simultaneity of "large market" factors such as revenue and payroll and success on the field**.** A better product on the field would be expected to generate more revenue and in turn a higher payroll. Thus, it is hard to determine whether

the big payroll teams were good because of their payroll or because their payroll was high because they were good.

One major assumption being made in all these previous studies was that the current state of affairs in baseball somehow differed from the historic state of competitive balance. Considering the Yankees do have twenty seven world championships, this may not be the case. Fortunately, Schmidt and Berri put this assumption to test in their paper "*Competitive balance and attendance: The case of Major League Baseball"*. Schmidt and Berri actually went back and compared this decade's state of competitive balance to that of every decade of the past century. Unlike any of the previously mentioned studies in this paper, this study put the current state of baseball into the context of the history of baseball. By doing so, Schmidt and Berri could observe whether the current growth in payroll gaps was actually causing the competitive state of baseball to differ from historical levels.

Similar to the previous two studies, this study measures competitive balance off a team's record. Like their previously mentioned paper, Schmidt and Berri (2001) developed a Gini Coefficient to measure how evenly distributed wins were across the league over each decade. By calculating a Gini coefficient for each season dating all the way back to 1901, the authors were able to put into context the supposed current decline in the competitive balance. With this new found context, the Schmidt and Berri came to the conclusion that the '90s were actually the most competitive decade of the century! This conclusion is of particular interest because the Blue Ribbon Panel also used wins to

measure competitive balance. However, the Blue Ribbon Panel did not put their conclusion into context of the history of baseball, which was an omission that skewed the story being told by the statistics they uncovered.

2.2 The Use of Betting Lines to Measure Competitive Play

This is not to say the work done by the Blue Ribbon Panel isn't without its merits. It brings up the very important correlation between payroll and post season success in the 1990's. The question that then follows is: if the 90's were the most competitive decade in the history of baseball based on win percentages then why were the top payroll teams displaying such dominance over the lower three quarters of the league in the post season? A solid answer may be found in the argument put forth in the paper *"Using Betting Market Odds to Measure the Uncertainty of Outcome in Major League Baseball"*. Paul, Weinbach, Borghesi, and Wilson(2009) illustrate that wins and win percentages may not be the best statistic to build any type of measure of competitive balance on.

This study sets out to attempt to answer why there was such a large discrepancy in the fans perception of the competitive balance of the 90s and the work done by Schmidt and Berri showing that it was actually the most competitive decade ever. To do this the authors take a unique approach and question whether wins are capturing the whole story of what is happening during a game. In place of wins the authors turn to betting lines to measure the change in competitive balance in baseball. Betting lines reflect the gambling markets expected outcome of a matchup in form a money line. With a higher money line the more certain the bettors were of the outcome of the game. Making it

possible to essentially measure the changing level of the fans perception of the competitiveness of the games over the course of the time period studied (1990-2006).

What the authors found was that fans were increasingly and significantly more certain of the outcome of the game. The betting lines increased in favor of the favorite by a total of ten percent over the course of the 1990s. More interestingly, the study found that the trend continued into the 2000's. The same decade that saw significant progress in the payroll gaps between the large and small market teams. The use of betting lines by the authors allowed a way to bridge the gap between the statistics and the fans perception of the game that was sorely missing in the previous studies trying to explain the fans perception of competitive balance based purely off statistics.

While betting lines offer a creative approach to turn human perception into a quantifiable statistic, they are still biased as they are derived from human perception. Thus, there is a need to test the efficiency and biasedness of betting lines. The article *"The Market Efficiency and the Favorite Longshot Bias: The Baseball Betting Market"* does just that. The authors, Linda M. Woodland and Bill M. Woodland(1994), cite previous literature on racetrack betting as their motivation to examine the baseball betting market. In this cited racetrack literature, a longshot bias is discovered revealing a market inefficiency where bettors over bet on heavy underdogs and under bet on favorites. The authors believe the baseball betting markets resemble a more pure market similar to the stock market and such inefficiencies will not exist. They put this hypothesis to the test with three weak form test on market efficiency.

First, the authors test the efficiency of a single randomly selected baseball game. A betting line on this game is deemed efficient if the probability of an underdog win does not differ from the objective probability of an underdog win. Simply, a betting line is efficient if it's not being biased by some form of human behavior that would lead bettors to place bets on underdogs disproportionally to their rational probability of winning. An example of this type of human behavior would be excessive risk taking. The results of this test showed an incredibly efficient market with only 3 of 26 lines rejecting the null hypothesis at a ten percent level. Next, a second test is done with all the lines on the baseball game aggregated together rather than examined individually. The results of this test do reject the null hypothesis of market efficiency at the ten percent level.

Turning to a final test, the authors examine if wagering only on underdogs returns higher profits than would be allowed for in an efficient market. If the strategy of wagering only on underdogs is inefficiency profitable, the market overvalues favorites. After running the test, the authors do detect market inefficiency. Particularly, this inefficiency is significant in games with heavy favorites. While the authors did find some deviation from consistency, they conclude it is not sufficient enough to exist as a profitable wagering strategy.

In total, the authors conclude the results of these test verify the baseball betting market is sufficiently efficient. With this verification, this papers approach of using betting's as a measure of competitive balance stands on more concrete grounds. If the results showed an inefficient market, the betting market would be heavily influenced by

irrational human behavior such as risk taking or fan bias. This would make betting's a poor fit to be used to get an accurate perception of competitive play.

However, this study does offer one concern that needs to be examined in this paper. A test for reverse long shot bias will need to be tested for in this paper to see if favorites are being overvalued.

3. Data Review

This paper uses three main pieces of data: win percentages, betting lines, and team payroll. These pieces of data were chosen to get a full picture of the story that was laid out piecemeal in the literature review section. Winning percentages are the classic measure of competitive balance and will be compared to the results of my new approach. Team payroll will be used to rank the teams by payroll for each year. By ranking the teams by payroll, an insight can be gained into the market size debate. Lastly money lines will be used, because as previously argued they will help develop a more accurate measure of competitive balance. This section of the paper will give a thorough examination of the data itself during the years 1989 to 2006.

3.1 Money Lines

In betting the money line shows the payout of a wager placed on the outcome of a specific game. For example a money line of -170 shows that it would take a wager of 170 dollars to win 100 dollars. This team would be considered a heavy favorite to win, so the payout is relatively low to compensate. Conversely, a money line of -170 would allow a better to gamble 100 dollars for a chance to win 170 dollars. This team is an underdog with a lower perceived chance of winning. Thus, an increased incentive is needed for gamblers to wager on this team.

The higher the absolute value of a money line, the more certain gamblers are of the outcome of that specific match up. In fact, the estimated certainty of the outcome implied by the money line can actually be calculated by converting money lines into probability. By converting money lines into probability, the bettor's forecasted outcome of a matchup is turned into a quantifiable percentage. Not only does this make comparing the favorite and underdog lines easier, but also allows for a clean comparison with winning percentages. For the purpose of this paper, the money lines will be converted into probabilities. This is done with the simple formula shown below:

For favorites, Money line/(Money line +1)

For underdogs, 1/(Money line+1)

Intrusively the use of betting lines would do a great deal to bridge the gap between fans perception and the statistics used in studies. Betting lines eliminate a good deal of fan bias as gamblers have a financial stake in the outcome of the game. Additionally, betting lines give a fuller picture about the true competitive nature of a game that classily used statistics cannot offer. For example, a win simply shows the outcome of the game. The score, be it 10-1 or 1-0, isn't taken into account. This leaves much to be desired when trying to precisely evaluate competitive play. Betting lines eliminate this problem as they are predictions based on the witnessed skill level differences between the two teams. Betting lines offer a really good midpoint between human perception and statistics.

When looking at the league as a whole, the issue with money lines or the probability derived from money lines is that if you take an average across the league the average will always be around 50%. Obviously, as one team always wins and one team always loses a game. This makes for a poor tool to look at for a year to year league wide comparison. To combat this, an Index of Dissimilarity can be derived to get a superficial glance of the competitive balance of the league on a yearly basis. The Index of Dissimilarity will be calculated to show how evenly the probability of winning is spread across the league. This will illustrate the competitive balance of the league because if the Index of Dissimilarity is high it shows a lack of competitiveness in the league. With some teams expected to win a large percentage of the games and some teams not expected to win many, a high Index of Dissimilarity would really work well to determine years in which the playing field was not competitive.

The formula used in this paper to compute the I.D. is as follows:

I.D.= .5*Sum |Teams proportion of total teams -Teams percentage of Money Lines probability of winning|

Moving back to the money line probabilities, an I.D. was computed to show competitive balance of the league as a whole without respect to payroll. Shown in the table below are the I.D. calculations for each year from 1989-2006.

Table 3- Money Line I.D.'s

Year	I.D.
1989	0.03048
1990	0.02524
1991	0.0214
1992	0.03071
1993	0.04079
1994	0.03869
1995	0.03514
1996	0.03928
1997	0.03613
1998	0.04929
1999	0.04881
2000	0.04551
2001	0.04662
2002	0.06058
2003	0.05967
2004	0.05283
2005	0.0447
2006	0.04504

Looking at the table, the Index of Dissimilarity was relatively low in the early 90's indicating that a low reallocation of the team probabilities will have to be done to make the league perfectly competitive. However, the table show a steady upward trend in the I.D. as the league became more unbalanced. The fans perception on the state of the league appears to have been correct as the I.D. almost tripled from its valley in 1991 to its peak in 2002. The league in fact did become increasingly less competitive in the later 90's and into the early 2000's.

One curious observation can be made by comparing the 90's to the 2000's. In the 90's, the top few teams like the Yankees and Braves dominated the decade. While in the 2000's, the league has seen a new World Series Champion almost every single year. Yet

this isn't reflected in the Index of Dissimilarity statistics. The I.D.'s of the 2000's show that the league is much less balanced than the 90's. A less balanced league, but one that creates a greater variety of champions is certainly an interesting phenomenon. It will be interesting to see if the winning percentage statistics show a similar story

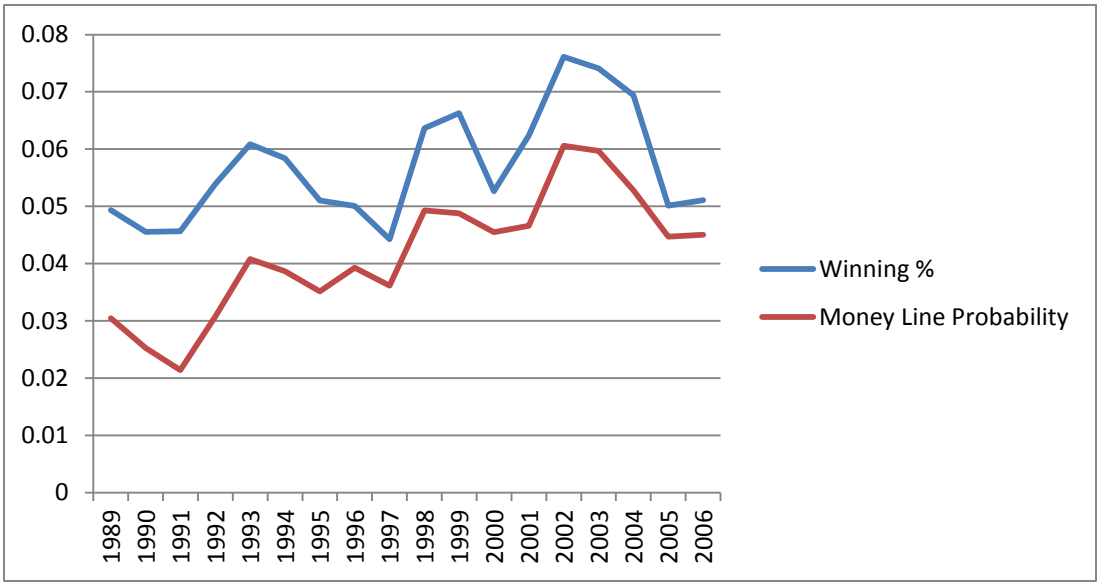
3.2 Winning Percentages

Winning percentages have classically been used to define the strength of a team as they show the percentage of games won out of the total games played. Two large issues with winning percentages exist, however, in the form of team scheduling and excluding the score of the game. Teams in weak divisions will have an easier time winning games. This makes a comparison between teams based purely on winning percentages imperfect. Additionally, the true competitive story of the games is ignored by winning percentages.

However, it would be lazy for this paper to simply ignore winning percentages. It is important to know how winning percentages and money lines compare over the time period examined. Calculating an Index of Dissimilarity for winning percentage really offers to give an exciting insight. One of the main premises behind using betting lines is the argument that the whole story isn't being caught up in classic statistics like winning percentages. By comparing the two head to head as raw statistics, it wouldn't allow for a true comparison. Winning percentages across the league will always average to near fifty percent. But by comparing how evenly the two are distributed across the league, a

comparison can be made. If the two differ drastically, it would explain why fans perception was saying a different story than that of the stat sheet.

Figure 3- Trend of Winning Percentages I.D



As the graph above shows, the I.D. of winning percentages offers a much different story than the I.D. of betting lines. While both trends show a similar pattern, the I.D. of winning percentages is full of peaks and valleys and not a steady drastic upward trend as shown in the graph of the I.D.'s of betting lines. The I.D. of Money lines never comes close to reproaching its low value in 1991, whereas the I.D. of winning percentages approaches its low value on multiple occasions. The I.D.'s of winning percentages simply seem to be all over the table. For instance, in 1997 during

the heart of the growing lack of competitiveness as shown by the Yankee domination and the I.D. of betting lines, the I.D. of the winning percentage is actually at a range wide low.

The great variation of the I.D.'s of the winning percentages makes it much harder to piece together a story with the information at hand. However this difficulty tells a story in itself. Perhaps this variation in I.D. of winning percentages could be used to explain while reports such as the Blue Ribbon Panel use wins and winning percentages to show a growing lack of competitive balance. While the paper "*Competitive balance and attendance: The case of Major League Baseball"*, shows the league at an all-time high in terms of competitive balance. An analysis on the variation of winning percentages and the variation of the conclusions research papers using winning percentages as a measure of competitive balance would make an interesting paper topic by itself.

3.3 Team Payrolls

Team payrolls are needed to evaluate team's spending effect on competitive play. Rather than do a direct analysis on payroll's effect on competitive play, payroll will simply be used to divide the league into quartiles. The quartiles will then be compared to show how they differ with respect to competitive play. Dividing the teams into quartiles allows for an insight into the debate centered on big market teams having a natural advantage over small market teams. Additionally, it falls in line with the approach previous literature has used to tackle this subject. Thus making the results of this paper suitable for a comparison to previous literature.

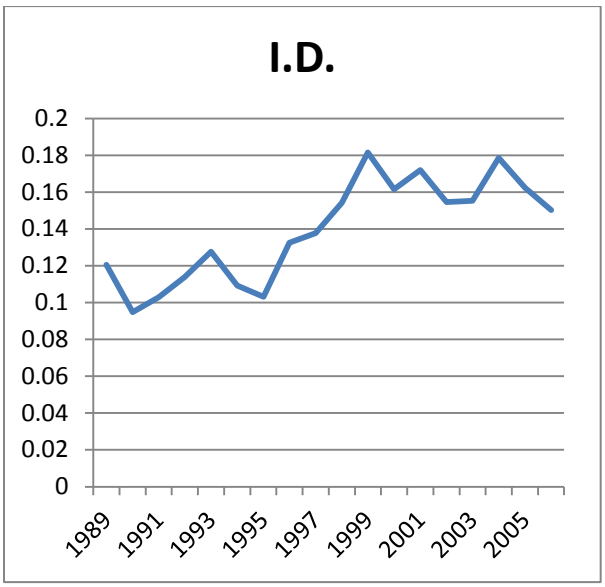
The teams in each quartile will change on a yearly basis as the quartiles are defined on spending patterns. Rather than a direct comparison on big market and small market teams, this will give an insight into the spending behavior of teams and its effect on competitive play. Ranking teams by their spending behavior gives an excellent insight into payrolls effects on competitive play. A big market team is simply a team that spends like a big market team should. This avoids the problem of thrifty owners. Additionally, this ranking and use of payroll falls in line with previous literature. The results of this paper can be compared to studies like the Blue Ribbon Panel report to see if the big market teams were actually pulling away as strongly as the report suggested.

Obviously, even the most casual fan can look at team salaries across the league and see that the landscape has drastically changed over the past two decades. However, creating an Index of Dissimilarity offers two quick and interesting insights. First, it gives a rather easy measure to show by how much the gap of the team payrolls has changed on a yearly basis. Secondly, it gives a rudimentary way to compare how the balance of the team payroll differs than the balance of competitive play in a single year.

As commonly known, the I.D. shows the phenomena of drastic growth and divergence in team payrolls across the league. Additionally, it shows how this divergence has leveled off in the 2000's. All in all, the I.D. of payroll seems to mirror that of the betting lines. Both showing steady positive trends that level off at the end of the data range. However, the largest difference is simply in the raw I.D. itself. The payroll I.D.'s are much larger than the betting line I.D.'s Showing that the growth in

payroll gaps is shown to have a much smaller corresponding growth on a teams average betting line.

Figure 4- Trend of Payroll I.D.



3.4 Long Shot Bias Test

One issue that needs to be addressed from the literature review section is that of the reverse long shot bias. A reverse long-shot bias suggest that bettors over bet on favorites. As discussed in "*The Reverse Favourite–longshot Bias and Market Efficiency in Major League Baseball: An Update" the* baseball betting market has evidence that shows it is influenced by these phenomena. If these phenomena were strong in the baseball betting market, it would be a large cause of concern for this paper. A strong reverse-long shot bias would mean this statistic would be ill served as a measure of competitive balance as

the strength of the favorites would then be exaggerated. Obviously, if the best team's strength was being exaggerated in the betting lines then the league would appear less competitive than it really is.

To test for the reverse long shot bias, this paper will use a simple test based on home team betting lines and the percentage of games actually won by the home team. Simply if the home team wins significantly fewer games than is predicted by the home team betting line, a reverse-long shot bias exist in this set of data. Home teams are on average favored to win throughout this data set, thus making this test suitable to test if favorites are being overly favored in the betting market.

After converting the home team betting lines into probabilities, a comparison between probabilities and win percentages is clean and simple. Essentially this test is comparing the probability of the home team winning against the percentage of games they actually won. The results can be seen in the table below.

On first glance, the average across all seasons shows that the home team's probability of winning was a fairly accurate predictor of wins. Only a slight bias was seen with the betting lines over predicting home wins by 2.7 percent. However on closer examination, the probability of winning is shown to be even more accurate.

In eight of the eighteen seasons, the difference between the home team probability of winning and actual winning percentage is less than one percent. Conversely, the home team probability of winning is only two or more percent greater than the actual winning percentage twice. One time being in the hectic strike shortened season of 1994.

While a slight and consistent bias is seen towards home teams, this bias is not significant enough to discredit betting lines as a measure of competitive balance. Overall, betting lines appear to be a remarkably accurate predictor of the outcome of games.

4. Test

The goal of this paper is to evaluate how significantly team payroll spending is affecting the competitive balance of the league. To make this evaluation, this paper needs to devise a way to quantify competitive play into a statistic that can be compared on a yearly basis. Essentially, a statistic measuring one team's strength in comparison to the rest of the league is needed. Once this statistic is computed, the league can be divided into payroll quartiles to analyze the relationship between a team being at specific payroll level and team strength. Finally, this analysis can be looked at on a year to year basis to find out if any change in the payroll gaps had a corresponding change in team strength gaps.

As previously stated, the first issue is to develop a statistic to quantify team strength in relation to the rest of the league. This is a fairly difficult task as traditional statistics such as wins are heavily influenced by uneven scheduling. Thus, making wins flawed in comparing team strength when teams are in different divisions or leagues. A more unique approach is needed. Fortunately, the paper "*Fundamentals or Noise? Evidence from the Professional Basketball Betting Market*" offers a statistic that may be adopted for used of this paper.

In the aforementioned paper, Brown and Sauer(1993) use a pricing model to turn the point spread lines used in the gambling market into a measure of team strength. The model used in the paper is shown below:

NBA game's Point Spread= Home team advantage coefficient + Sum (Team Ability) *Dummy Variable if team is home or away + Market information.

The model states that the point spread used by gamblers is essentially computed by finding the difference in team ability and adding a constant for home field advantage. Consideration for market information such as injuries is also taken into account.

By plugging the above pricing model into a statistical regression with the point spread as the dependent variable, coefficients can be calculated to show how much a team being involved in game effects the point spread. These coefficients are effectively measures of team strength. Unlike wins, these coefficients avoid the problem of uneven scheduling by allowing for a larger variance in the statistical range. A win is simply a binary statistic that is a 1 or 0. This measure of team strength can be 10 or -8. This larger range of statistics allows for a more precise insight into team strength in relation to the rest of the league.

This pricing model can easily be adapted for use in Major League Baseball and money lines as shown below.

Probability of winning from Money Lines=Home field effects +Sum (Team ability) * Dummy variable if team is home or away+ Market Effects

Money lines make a more suitable dependent variable in Major League Baseball as teams such as the 2010 Giants have shown the ability to win a lot of games and the World Series while having low margin of victories. The low margin of victories comes from having a dominant pitching staff and a weak offense.

However, two small tweaks will be made the Dr. Sauer's pricing model before use in this paper. The first is that the pricing model will be used to run two separate regressions. One for each league, to minimize the problem of uneven scheduling. The second tweak will be done to the coefficient themselves. Simply, the true adjusted coefficient is the coefficient of the team ability minus the league average team ability. Leaving a simple interpretation of how much better or worse a team is than the league average. Additionally, the balance of the league is easily derived from these new adjusted coefficients by simply looking at the standard deviation and range of the coefficients.

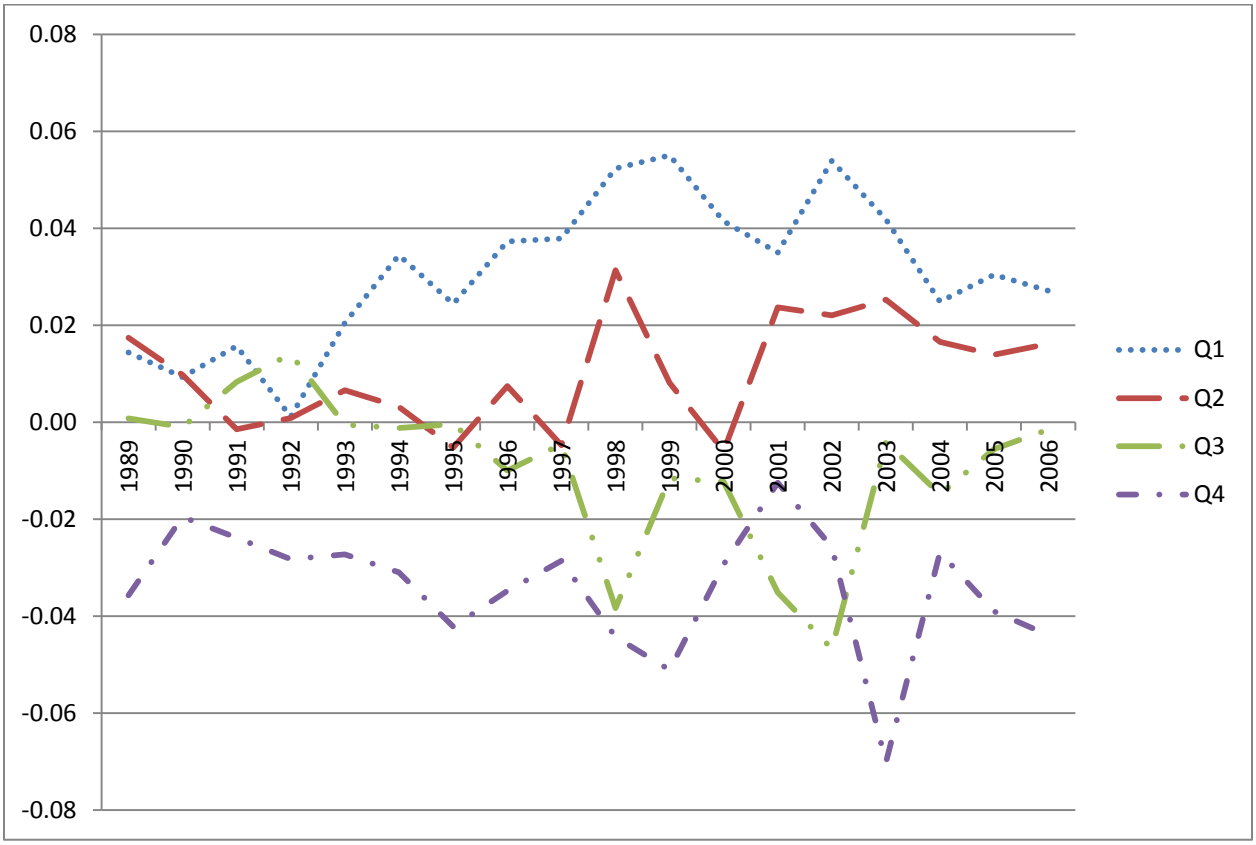
5. Results

5.1Team Strength Coefficient Trend Analysis

In the data review section, a very superficial analysis was given on the changing level of competitive balance over the time period studied. However, this analysis examined the league as a whole and left a lot of the story behind the competitive balance of the league untold. A much deeper insight is given with the regression analysis test as the league is broken down and examined by individual teams. By doing an analysis on the individual teams, a deeper and more precise analysis can be given on the relationship between competitive balance and the gap between team payrolls.

From the I.D. of the money lines, the league was seen to get significantly less balanced. Intuitively, it would be expected that Quartile 1 teams were simply pulling away as baseball fanatics everywhere argued. The graph below shows this is partially what did occur.

Figure 5- Team Strength Coefficient by Quartile



The graph above indicates three unique trends of competitive balance during the time period examined. The first trend occurred during 1989 to 1992. The top three Quartiles were closely grouped together, with Quartile 4 lagging far behind. Team strength coefficients being built on the betting markets perception of a team's strength, having the top three quartiles grouped so closely together would indicate that the common perception was that the league was extremely competitive during this time.

The second trend saw Quartile 1 separate itself drastically from Quartile 2 and Quartile 3. This trend occurred between the years 1993 to 2000. Starting roughly in 1993, Quartile 1's average team strength coefficient began to rise. Quartile 2's average team strength coefficient stagnated and Quartile 3's average team strength coefficient dropped dramatically. Factoring these three growth rates together, the league saw Quartile 1 teams really begin to display dominance. Considering these team strength coefficients are based on gamblers perception of a team's probability of winning, Quartile 1 teams were expected to win at a very high rate compared to the rest of the league. This perception clearly was shared by the minds of the public whose cries against large market team spending grew louder during this time period.

The final trend seen occurred during the years 2001 to 2006. The Index of Dissimilarity still saw the league becoming increasingly unbalanced during this time frame. However, the coefficients of team strength show that there was convergence of Quartile 2 and Quartile 3 teams to move more back in line with Quartile 1 teams.

This trend clearly illustrates why there was such a greater variety of World Series champions during this time period. The gap between Quartile 1 and Quartile 2 teams narrowed greatly with Quartile 3 teams trending heavily upwards. Simply, the dominance of a few teams was lessoned by the emergence of steeper competition from Quartile 2 and Quartile 3.

Another interesting note about this trend is the fact that the Index of Dissimilarity did not detect the league becoming more balanced at this time. An easy explanation is

the steep drop in quality of play from the teams in Quartile 4. Illustrating the problem with viewing the league as a whole to examine competitive balance, the struggles of Quartile 4 teams offset the increased quality of play from Quartile 2 and Quartile 3 teams. The league actually saw much more competition at the top, as evident by the increased variety of champions, but was seen to show little increase in competitiveness due to a few teams at the bottom.

5.2 Payroll Trend Analysis

The results of the team strength coefficient regression showed three distinct trends. The hypothesis put forth by fans as to why these trends occurred falls on the back of team payroll spending. According to the general public, the trends would be explained by the rise and fall of large market team spending. This can easily be put to the test by examining if there was a corresponding change in large market team spending patterns to go along with these changing trends of competitive balance.

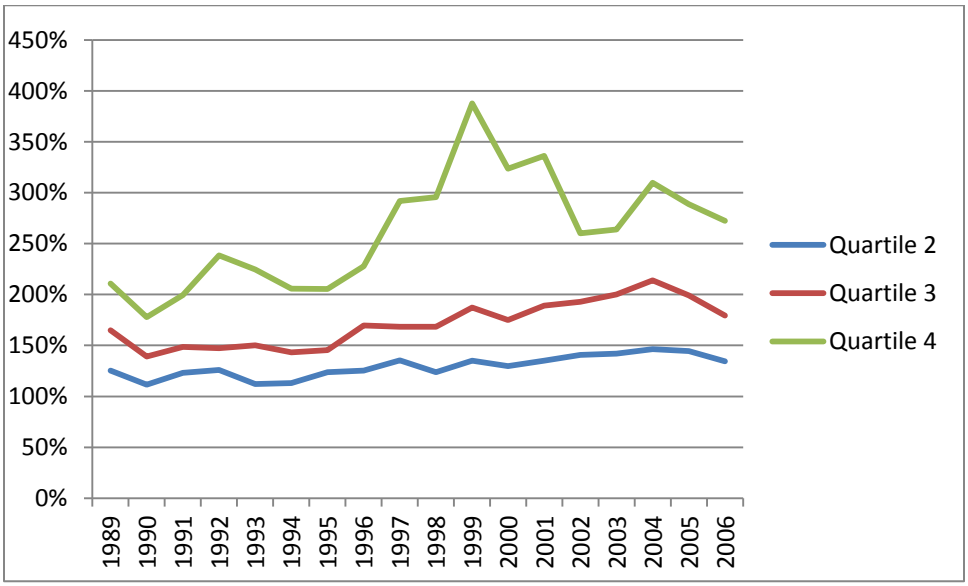
Simply all that needs to be done is to examine the payroll relationship between Quartile 1 and the other Quartiles during the years in which there was trending converging or diverging level of competitive balance. For example during the years 1993 thru 2000, Quartile 1's payroll relationship to Quartile 2 and Quartile 3 should be diverging compared to the prior years 1989 to 1992. The below shows what should be expected if payroll was the driving factor behind these trends in competitive balance.

Table 4- Payroll Trend Analysis

Payroll compared to Quartile 1	1989-1992	1993-2000	2001-2006
Quartile 2	Close	Growing Far apart	Growing very close
Quartile 3	Close	Growing Far apart	Growing somewhat close

A quick glance at the graph below shows the payroll trends do not correspond to the trends in team strength as expected. Most notably, Quartile 1's payroll relationship with Quartile 3 is relatively stagnant over the entire time period. In fact the only time period where Quartile 1 makes consistent and significant growth over Quartile 3, is during the years 2000-2006. The same time period which Quartile 3 closed the gap in competitive strength!

Figure 7- Quartile 1's Payroll Relationship



A similar trend is seen with Quartile 1's relationship with Quartile 2. During 1993-2000, Quartile 1 pulled away significantly from Quartile 2 in terms of team strength. Quartile 1's payroll in comparison to Quartile 2 actually went down from 1989-1995 and really didn't start pulling away sharply until the 2000's. The effect seen here is almost inverse to what was expected.

Putting the graphs trends in more concrete and discernible numbers, the chart below analyzed the trend in Quartile 2's payroll in comparison to Quartile 1 and Quartile 2's quality of play. Quartile 1 experienced rampant success during the mid and late 90's, but only increased the payroll gap between itself and Quartile 2 by 2.7%. That rather

small increase in the payroll gap between the two Quartiles corresponding with Quartile 2 having a huge 23% drops in its average coefficient of team strength.

Table 5- Quartile 1 and Quartile 2 Comparison

Years	Q1 Team Strength	% Change	Q1/Q2 Team Salary	% Change2	Q2 Team	% Change
1989-1992	0.01011862		1.215090376		0.00665	
1993-2000	0.037886767	377%	1.247809792	2.70%	0.00509	-23%
2001-2006	0.0355252	-6%	1.404889414	13%	0.01961	385%

On face value, it seems impractical that Quartile 1 increasing its payroll gap over Quartile 2 by 2.7% would correspond to Quartile 1 experiencing a 377% growth in team strength coefficients while Quartile 2 experiences a 2.7% drop. Going a few years further, the likelihood that payroll gaps are the driving factor in the competitive balance between the two Quartiles grows even smaller. During 2001-2006, Quartile 1's team strength coefficient dropped 6%. Six percent, despite the fact that it actually increased its margin in terms of payroll in terms by 13%. Conversely, Quartile 2 was payroll was actually poorer in comparison to Quartile 1 during this time frame, but increased its team strength coefficients by 385%.

Logically, team payroll gaps cannot be the driving force affecting the competitive levels amongst the teams in the league. A small positive change in the payroll ratio in the 90's saw a huge change in the gap of competitive play, but a much larger positive change in payroll ration in the 2000's saw the gap of competitive play shrink. Simply, there is no conclusive trend.

6. Conclusion

Fans have long complained of the big market dilemma in baseball where the teams in the largest cities had an unfair advantage over the rest of the league. This issue accumulated fervent support after the New York Yankees reeled off four World Series wins in five years in the late 1990's. Numerous studies followed to examine the big market dilemma and the competitive balance of baseball in general and the conclusions of the studies varied mostly dependent on the method the authors used to define competitive balance. This paper examined those studies and saw what could be leading to drastically different conclusions: classical statistics such as wins do not truly tell how strong a team's quality of play is.

This paper elected to use betting lines as the measure of competitive play to offer a bridge between the stat sheet and the eye test. The paper tested the accuracy of betting lines, used betting lines to measure league balance as a whole with an Index of Dissimilarity, and then finally used in a regression analysis test to show betting lines relationship with team payroll.

With the Indices of Dissimilarity based on the betting lines, the league was seen to get increasingly and significantly less balanced from 1989 -2006. However, this left a lot to be explained as while the league was getting increasingly less balanced, there were a greater variety of World Series champions. Additionally, the Indices of Dissimilarity do not give an insight into competitive balance with respect to team payroll. While the payroll gaps and I.D.'s grew correspondingly without looking directly into the

relationship between the team payroll and a team's ability, there is no way to get an accurate picture of what is actually taking place.

To get an insight into the relationship between team payroll and team ability, this paper needed to calculate a statistic that could accurately be used to compare a team's strength with respect to the rest of the teams in the league. Betting lines were chosen as they forewent problems such as weak divisional play and relied solely on market perception of the team's ability. Next, the betting lines were converted into probabilities and then plugged into a pricing model developed by Raymond Sauer. This pricing model was run as a statistical regression to return coefficients to show how much a team being involved in the game positively or negative influenced the money lines. These coefficients effectively turned the gambling markets perception of a team's ability into a quantifiable statistic that could be compared against one another.

These coefficients allowed a clearer insight into the story of competitive balance than was being told by fans perception, win statistics, or the I.D. of the money lines. Fans argued that the rampant spending by big market teams was destroying the competitive balance of the league. Win statistics showed no clear trend giving a clear indication that the competitiveness of the league was changing hand in hand with the payroll gaps. The I.D. of money lines supported fan perception that the league was becoming increasing less balanced.

However, the coefficients for team strength allowed this paper to discover an aspect that fans and the I.D. of money lines were missing. Early in the time period

examined, the top three quartiles were grouped closely together. A divergence between these quartiles reinforced fan's sentiment that Quartile 1 teams were beginning to dominant the league. The interesting aspect here, however, occurred in the early 2000's with the convergence of the top three quartiles once again. This went relatively unnoticed when examining the league as a whole, because Quartile 4 teams experienced a corresponding drop in competitive play.

Evidence of Quartile 1 separating itself in terms of competitive play was found in this paper. The team strength coefficients saw Quartile 1 drastically become more expected to win an average random game during the years 1993 to 2000. This is roughly the time period examined by the Blue Ribbon Panel after an onslaught of criticism about the competitive balance of the league as onlookers saw the New York Yankees win four World Series in a five year span.

The Blue Ribbon Panel saw Quartile 1 teams separate themselves in a similar manner as this paper, but came to a significantly different conclusion why. Superficially, the Blue Ribbon Panel looked at the overall percent growth of the team payrolls for each quartile during this time period and saw Quartile 1 grow at a significantly faster rate than the other three quartiles. This led to the panel to conclude that team payroll gaps were the driving factor between growing gaps in quality of play between the teams.

This paper did not take such a shallow look and came to a distinctly different conclusion. If Quartile 1's payroll relationship with Quartile 2 and Quartile 3 is

examined during different periods where their competitiveness with one another is seen to be converging or diverging, then relationship between team payroll gaps and gaps in team ability found by the Blue Ribbon Panel is not so conclusive. In fact, this paper saw Quartile 1 pull away from Quartile 2 and Quartile 3 in team payroll during the same years that Quartile 2 and Quartile 3 drastically became increasingly more competitive.

This paper concludes that there have been significant trends and fluctuations of competitive balance during the time period examined (1989-2006). Due to the inverse relationship seen with the team payroll relationships and competitive balance gaps in the 2000's, this paper goes against popular belief and concludes team payroll gaps were not the cause for the changing level of competitive balance. This paper also finds betting lines to be a more accurate indicator of competitive balance than win statistics. Previous literature found little progress made in the 2000's in terms of competitive balance. Spurred on by the increased variety of World Series champions, this paper evaluated these years specifically and found a huge increase in competitive play from Quartiles 2 and Quartile 3. The betting lines picked up information that the win statistics were not and explained why there have been so many different World Series champions since the turn of the century.

Appendices

Appendix A:Team Payroll and Team strength statistics

Table A-1: Payroll Pre-Strike Years by Quartile

	1989	1990	1991	1992	1993	1994
Q1	18,789,068	21,959,322	32,471,417	41,655,348	40,684,405	41,089,948
Q2	15,004,775	19,682,500	26,357,695	33,046,003	36,249,276	36,343,494
Q3	11,386,841	15,790,928	21,853,881	28,270,810	27,104,429	28,711,147
Q4	8,906,594	12,358,832	16,283,156	17,457,361	18,107,769	19,965,192

Table A-2: Team Coefficients Pre-Strike Years by Quartile

	1989	1990	1991	1992	1993	1994
Q1	0.014364	0.009315	0.015694	0.001102	0.020454	0.034427
Q2	0.017436	0.009757	-0.00147	0.000871	0.006612	0.00316
Q3	0.000823	-0.00098	0.008321	0.014052	-0.00053	-0.00116
Q4	-0.03567	-0.01955	-0.02382	-0.02822	-0.02724	-0.03095

Table A-3: Payroll of the late 1990's

QUARTILE	1995	1996	1997	1998	1999
Q1	42,188,291	45,214,207	59,148,877	58,778,131	76,048,926
Q2	34,079,368	36,078,239	43,667,548	47,550,625	56,318,258
Q3	29,039,965	26,662,154	35,133,369	34,914,802	40,590,237
Q4	20,526,553	19,847,679	20,263,310	19,876,714	19,616,143

Table A-4: Team Coefficients of the late 1990's

	1995	1996	1997	1998	1999
Q1	0.024388	0.03726	0.03785	0.052302	0.05501
Q2	-0.00523	0.007464	-0.00475	0.031327	0.008085
Q3	-0.00041	-0.00995	-0.00454	-0.03837	-0.01152
Q4	-0.04216	-0.03477	-0.02856	-0.04426	-0.05109

Table A-5: Payroll of the 2000's

QUARTILE	2000	2001	2002	2003	2004	2005	2006
Q1	84,198,334	99,710,432	103,685,097	110,348,552	112,195,608	115,524,488	116,420,317
Q2	64,899,120	73,895,442	73,734,760	77,736,667	76,597,656	79,905,863	86,635,973
Q3	48,146,458	52,711,375	53,749,448	55,167,637	52,440,906	57,995,460	64,926,954
Q4	26,003,881	29,659,179	39,858,312	41,783,976	36,226,884	40,000,700	42,751,579

Table A-6: Team strength coefficients of the 2000's

	2000	2001	2002	2003	2004	2005	2006
Q1	0.041403	0.034993	0.053894	0.041849	0.02487	0.030414	0.027132
Q2	-0.00593	0.023677	0.022057	0.025282	0.016566	0.013955	0.016136
Q3	-0.01224	-0.03507	-0.0467	-0.0041	-0.01484	-0.00553	-0.00149
Q4	-0.02927	-0.01249	-0.02573	-0.07012	-0.02685	-0.03898	-0.04387

Table A-7: Long Shot Bias

	99	2000	2001	2002	2003	2004	2005	2006
win %	52%	54%	53%	54%	56%	54%	55%	55%
bet line	51%	51%	51%	51%	51%	51%	51%	51%
Difference	0%	2%	1%	3%	5%	2%	4%	4%

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