5-2016

Income Inequality in American Professional Sports Leagues

Joshua S. Thurman
University of Arkansas, Fayetteville

“Income Inequality in American Professional Sports Leagues”

Joshua Thurman

University of Arkansas

Advised by: Professor Dongya Koh

Abstract:

Sports leagues provide an interesting window to view issues that larger economies face that are much harder to measure due to their complexity. These leagues have many policy tools similar to those used in major world economies such as minimum wage, price ceilings, labor unions, and revenue sharing, although the impact of these policies are much easier to measure in the closed economy model of a sports league because the income and output of every player in a given year is known. In this paper, I measure the level and trend of income inequality in the NBA, NFL, and MLB, by deriving the Lorenz Curve of income inequality for each league and calculating a GINI index for each league. From here, I will compare the structural differences and similarities in the salary cap and revenue sharing models of each league to determine the impact of these policies on income parity. The results reveal that MLB is the most unequal of the leagues as measured by GINI index, variance of league salaries, and average variance of team salaries as a result of a soft salary cap and weak revenue sharing model. When measuring the GINI index by the total amount of money contributed to the salary cap each year, the NBA is slightly more equally distributed than the NFL, however this difference disappears when simply measuring GINI by a player's base salary due to the excessive use of bonuses in player contracts in the NFL.

Introduction

Imagine an entity that has a central governing body serving over numerous semi-autonomous institutions. These institutions must abide by a set of rules introduced by the governing body, but are permitted to set some of their own rules to govern their citizens, provided that they do not directly conflict with the rules agreed upon by the governing body. Representatives from each institution make up the governing body, which is presided over by an elected leader with a specified set of powers. Each institution is allowed to set its own budget and raise its own revenue; however it must pay taxes to the governing body. This entity allows imports, that is to say it is not closed off to other entities, though it has special rules to facilitate the arrival of imports. Inside this entity there exists a minimum wage as well as a progressive tax based on earnings. The minimum wage and other issues involving the well-being of the citizens are expressed through a labor union which takes part in negotiations with the governing body, but is not part of the governing body. Does this entity sound familiar? The picture painted above no doubt appears to be the Federal system that defines the United States of America. It might come as a surprise, however, that this entity could also be Major League Baseball (MLB), the National Football League (NFL), or the National Basketball Association (NBA).

It is perhaps not by mistake that the organization of the highest sports institutions in America closely resembles the organization of the United States government at first glance. For the purposes of this paper, the similarities that exist between the structure of the United States government and the previously mentioned professional sports leagues permit easy comparison between how specific choices in their organization has affected the allocation of resources, specifically wages. In line with the thinking presented in the previous paragraph, we can begin to think about American professional sports leagues using a variety of well-known economic ideas. Sports leagues in particular allow for unique examination because the income of every player (or laborer) is known and their production in a given year can be easily measured, whereas this type of

data is nearly impossible to compile for any given country. This is to say that an individual sports league can be thought of as a “closed economy”, where the allocation of resources, income, and production of every member in a given year is known, and these inputs and outputs remain inside this economy. It is worth noting that a player may enter a league during the course of a season from another league, for instance a MLB team could sign a player from the Japanese professional baseball league, but the exchange of resources is between the player and MLB team, meaning that the wealth remains in the economy. Given that we now have three distinct economies (MLB, NFL, NBA) with easily comparable structures, we can examine how specific policy decisions, for instance the use of price ceilings and floors (salary caps and minimum wage), have impacted the distribution of wealth in each league. This comparison would be extremely difficult if not impossible for most countries given the incredible complexity of the economy and the fact that a policy decision made in one country could impact the flow and allocation of resources in another. The unique “closed” nature of the these three leagues combined with easily measurable macroeconomic variables allow us to isolate the impact of policy decisions on wealth distribution in a quantitative way that would be much more difficult in a more complex, open economy.

This paper will seek to quantify the differing levels of income inequality, measured through yearly player salary, between MLB, NFL, and the NBA, and assess how differences in the laws governing the leagues may have contributed to these varying levels of income inequality. Specifically, I will examine whether the use of a salary cap and contract structure in each league has led to increased or decreased income dispersion. Before presenting my findings, further explanation will be given to the specific structure of each league and how the data was used to capture income inequality. This paper will ultimately answer the question, “Which American professional sports league has the highest level of income disparity and what set of organizational decisions created this inequality?”

The main empirical analysis of this paper will be based on the derivation of the Lorenz Curve and GINI coefficient for each league as well as the variance in the logarithmic values of salaries within each league. The Lorenz Curve plots the actual income dispersion of an economy against "perfect equality". The line of perfect equality shows that every player has equal income, and an increase of one player always yields a fixed increase in cumulative income for the entire league. The further that the observed curve deviates from this curve represents an increased level of inequality, meaning that an increase of one player may yield a more than proportional or less than proportional increase in cumulative league income. From the Lorenz Curve we can derive the GINI coefficient for each league, which is a numerical calculation of income inequality on a scale of 0 to 1. A GINI of zero signifies perfect equality, meaning that every player makes the same salary while a GINI of 1, perfect inequality, means that one player controls all the salary of a given league. From here, calculations of the variance in salary of each league, the variance of salary of each team in each league, and a breakdown of variance by income percentiles, will help to answer the question of where exactly within each league the income disparity is originating. I will then examine how the use of revenue sharing, salary caps, minimum wage, and luxury tax have impacted the allocation of wealth.

Before proceeding to the results section of this paper, I will overview the key organizational concepts in Major League Baseball, the National Football League, and the National Basketball Association and state my hypotheses as to how these will impact the inequality differences in each league, discuss relevant literature on the topics on this paper and how those concepts are complimented by the research in this paper, and provide insight on the origins and application of the data.

Organizational League Overview

In order to contextualize the variation in income distribution in MLB, the NFL, and the NBA, it is important to understand the policy decisions impacting the allocation of wages. An aspect of this research that makes the analysis more interesting is the fact that all three leagues

have chosen a different method of impacting player compensation, allowing a clearer picture of the outcomes of these policies and how they compare to other leagues. In this section, I will discuss the key differences between the "luxury tax" system used in Major League Baseball, the "hard" salary cap in the National Football League, and the "soft" salary cap model in the National Basketball Association.

The use of salary caps and revenue sharing models in professional sports did not arise with the goal of equalizing income for players, but rather came as the result of another policy known as free agency. Historically, players for professional sports teams would play their entire careers for one team unless they were traded, as contracts contained reserve clauses that effectively tied them to the team that signed them first. Beginning in the 1970s in Major League Baseball, players began to argue that they had the right to sell their labor on the open market to the highest bidder: free agency. In 1976, the Major League Baseball Players Association (MLBPA), a labor union comprised of all MLB players that collectively bargains league rules and player issues, won a court case against MLB that granted players the right to sign with any team they chose after their contract had expired. The NFL followed suit in 1992 and the NBA soon after in 1996, and today every major professional sports league has adopted basic free agency for players. The introduction of free agency undoubtedly had a profound impact on income distribution in professional sports, as players could now determine and pursue a market value for their talents rather than being beholden to the appraisal of a single team, though it is the impact of the policies arising as a result of free agency that his paper focuses on. The negative consequence of free agency was the erosion of competitive balance, or the level of parity between the best and worst teams in a given league. Free agency favors big market teams, or teams that have a wider support base and are capable of raising more revenue than a small market team. Teams that made twice as much revenue could spend twice as much money on players and small teams would have no way to compete, resulting in a league dominated by a few teams year after year. It is here that the argument begins for whether team owners should be profit maximizers or win maximizers. There exists an inherent tension between

team owners and fans with regards to competitive balance. From a fan point of view, there is a tradeoff between fans of the home team wanting their team to win and neutral fans wanting a game with an unknown outcome and close score. By thinking of these two tradeoffs as a utility function, there exists some Nash Equilibrium with a perfect competitive balance in the league to satisfy both parties that can be mathematically derived (Késenne, Stefan, and Koning). This clashes, however, with the idea of win maximizing team that seeks to spend as much as possible on the best available talent in order to win. In this system, large market teams would dominate and few neutral fans would be enticed to spend money to watch games, resulting in a loss in league revenue that would ultimately harm those same large market teams financially. A profit maximizing team, on the other hand, would seek to spend the least amount of money possible on salaries while maximizing firm profit, an endeavor that could ultimately lose them fans, thus not maximizing the utility of the "home team" fans mentioned above. In reality, teams are more likely to be win maximizers as long as their budget constraints dictate that it is profitable to do so. Smaller market teams simply can't generate the revenue required to acquire the talent to maximize wins, and therefore seek to maximize wins up to what is feasible from a profit standpoint (Totty, Evan S. and Mark F. Owens). Weak teams, therefore, impose a negative externality on the large market teams that dominate the league, and the idea for a salary cap that limits the total amount that one team can spend on player salaries in a given year was introduced to improve competitive balance and partially internalize this externality. The salary cap levels the playing field by capping what large market teams can spend in an effort to normalize the salaries of players around the league and improve competitive balance in the hopes that it maximizes league revenue and fan utility. While free agency reduces competitive balance and increases the cost per unit of labor, a salary cap seeks to reverse or stem the effects of both of these, and has been shown to decrease the cost per labor in leagues that employ a salary cap and revenue sharing (Dietl, Helmut, Markus, and Rathke). Coexistent with a salary cap, all three leagues have instituted some form of revenue sharing to equalize the revenue earned by all teams in efforts to increase competitive balance. Although the execution of revenue sharing systems differ in

MLB, the NFL, and the NBA, the basic idea is to pool a portion of the revenue earned by all the teams and distribute it in equal portions, in which teams earning a relatively high amount of revenue compared to other teams get less than they put in and small market teams conversely receive more than they contributed. While all three leagues have adopted some form of the policies explained above, the details of their implementation have key differences that will later come in to play when explaining the differences in income distribution.

The NFL uses a “hard” salary cap as well as revenue sharing, making it the strictest of the three leagues in how it goes about limiting team spending. A “hard cap” means that the league determines the maximum amount that a team can spend in a given year on player salaries and no team may spend more than that amount, with one exception. All contracts in the NFL must be approved by the league office, and any contract that would place a team over the salary cap in a given year is rejected. The exception to this rule is known as the carry over rule, which states that if a team spends under the salary cap in one year, they may carry over the difference between the salary cap and what they spent into a different year if they notify the league. For example, the salary cap in the NFL in 2014 for every team was $133 million. If a team spent $128 million that year, they would be eligible to carry over the $5 million difference into the 2015 season, and spend an additional $5 million over the 2015 salary cap. The salary cap is determined by the NFL before the start of every season through a complex formula that calculates all league revenue from ticket sales, luxury boxes, local and national TV broadcasting deals, royalties, concessions, parking, stadium leasing, and merchandising, and then dividing that number equally between 32 teams. 48% of that number is attributed to “player costs” which include salaries and player benefits such as health care, pensions, and tuition. The portion of player costs that includes salaries is the salary cap number that each team can spend in a given year. With regards to an individual player, the amount of compensation that he receives is calculated for a given year based on his base salary in that year and any bonuses received including options and signing bonuses, which can be prorated over the life of the contract.

In contrast with the NFL, Major League Baseball does not have a salary cap but rather a "luxury tax" that sets a salary cap number similar to the calculation in the NFL, but taxes teams on a progressive basis if they spend over the salary cap number rather than preventing teams from spending over it. The luxury tax works by assessing a penalty to the team for whatever amount of money that they spend over the salary cap. If a team did not spend over the salary cap in the previous season, they would pay a 17.5% tax on the difference between what they spent and the salary cap in that given year. The tax increases to 30% if the team spent over the cap the previous year, 40% if the team paid the 30% tax the previous year and spent over the salary tax this year, and 50% if the team paid the 40% last year and spent over the cap this year. As an example, if the salary cap for 2014 was $100 million and a team spent $110 million in 2014, but did not pay any luxury tax the year before, they would pay a 17.5% tax on the $10 million difference for 2014. If the salary cap for 2015 was $120 million and the same team paid $150 million in salaries, they would then pay a 30% tax on the $30 million difference for 2015 because they went over the cap in the previous year and this year as well. In tandem with the luxury tax system is Major League Baseball's revenue sharing program, in which all teams contribute roughly 34% of net local revenue to a pool that is divided up equally between all 32 teams. In addition, a supplemental plan assigns each team a performance factor each year, which can be positive or negative. Teams with positive performance factor percentages pay an additional percentage of the 34% they contributed in net local revenue while teams with negative performance factor percentages receive an additional percentage of net local revenue in addition to the base revenue sharing payout. For example, a team with a performance factor of 7% would pay the base 34% of revenue sharing plus an additional 7% of net local revenue. A team with a performance factor of -7% would pay 34% of net local revenue to the revenue sharing pool but would get back 7% of whatever they paid in, plus the payout of the base revenue sharing. The goal of the supplemental plan is to increase the effective amount that the largest market teams pay while increasing the amount received by the smaller market teams, or those with negative performance factors. It is worth noting here that net local revenue includes a

nearly comprehensive list of team revenue that is eligible for contribution to the revenue sharing pool with the notable exception of local TV deals, which are exclusive broadcasting rights for home games sold to local television stations, but I will return to this issue in the results section.

The NBA undoubtedly has the most complex and flexible competitive balance program of the three leagues discussed in this paper with the combination of a “soft” salary cap and a revenue sharing plan. The value for the salary cap every year in the NBA is set in a similar manner to the NFL. Yearly basketball related income is projected before the season and agreed upon by team owners and the Players Association, which acts as a labor union for the players. A portion of yearly basketball income is then determined as player costs comprised of benefits and salaries and similar to the NFL, the salaries portion marks the salary cap line for a given year. That is where the similarities between the NFL and NBA salary cap system end, however, as the NBA uses a “soft” cap. Recall that in the NFL a team can not violate the salary cap rule set by the league unless they have leftover space from the previous year. In the NBA, teams can employ numerous exceptions to go over the salary cap line, and in practice few teams are ever under the salary cap set by the league. The most notable exception is the so called “Larry Bird Rule” which allows a team to resign its own player to a maximum contract if that player has been with the team for at least 3 seasons and does not violate any restrictions on the rule. Additionally, the “Early Bird Rule” allows a team to resign one of their own players that has been with the team at least two seasons to a contract valued at the highest of 175% of his previous contract or 104.5% of his average salary in the previous season, with a few minor exceptions. The NBA is also unique from the other two leagues discussed in that a player has a defined maximum salary number that increased incrementally based on the number of years the player has been in the league. The maximum yearly salaries for the years covered in this paper are shown in Table 1 below.

Table 1

Years in NBA[1]	**Defined maximum salary**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
0 - 6	25% of cap[2]	$12,922,194	$13,668,750	$13,701,250	$14,746,000	$16,407,500
7 - 9	30% of cap[2]	$15,506,632	$16,402,500	$16,441,500	$17,695,200	$19,689,000
10+	35% of cap[2]	$18,091,071	$19,136,250	$19,181,750	$20,644,400	$22,970,500

The NBA can be viewed as a hybrid system of the MLB and NFL in that it employs its own version of the salary cap like the NFL, but also uses a luxury tax like MLB that works in tandem with its soft salary cap. The luxury tax is calculated using the same method as the salary cap, though it takes a larger portion of basketball related income before removing player benefits to get the salary portion. Teams that spend over the soft salary cap using their exceptions that also spend over the luxury tax line are taxed on every dollar they spend over the luxury tax rate in an increasing amount up to a certain maximum. A summary of the luxury tax system for the NBA per the newest Collective Bargaining Agreement is shown in Table 2 (Coon).

Table 2

Team salary above tax level		**Non-repeater**		**Repeater**	
Lower	**Upper**	**Tax rate**	**Incremental maximum**	**Tax rate**	**Incremental maximum**
$0	$4,999,999	$1.50	$7.5 million	$2.50	$12.5 million
$5,000,000	$9,999,999	$1.75	$8.75 million	$2.75	$13.75 million
$10,000,000	$14,999,999	$2.50	$12.5 million	$3.50	$17.5 million
$15,000,000	$19,999,999	$3.25	$16.25 million	$4.25	$21.25 million
$20,000,000	N/A	$3.75, and increasing $.50 for each additional $5 million.	N/A	$4.75, and increasing $.50 for each additional $5 million.	N/A

In addition to the exceptions listed above, there are several Mid-Level Tax exemptions designed for teams that are below the luxury tax level that allow them to sign a free agent for a specified contract without being taxed above the luxury tax, provided they meet certain criteria. For purposes of comparison, the organization of the revenue sharing model in the NBA is essentially identical to that

of the NFL, though there is a cap on the incremental amount that the largest and most profitable teams can contribute.

Conceptually, based on the information described above, I expect that Major League Baseball will be the most inequitable of the three leagues in terms of player salaries due to the nature of their "soft" cap with no price ceiling. While it is true that teams are heavily taxed for spending over the salary cap, there is no theoretical upward limit on what a team can spend on a player as there is with maximum contracts in the NBA or a "hard" salary cap in the NFL. Because the NFL has a hard salary cap that artificially limits the potential amount of contract variance in addition to strict revenue sharing rules, I expect that the NFL will have the lowest GINI index with the NBA somewhere between the NFL and MLB. Now that the groundwork has been laid to understand the concepts that will be discussed later in the results section and what key differences I will focus on between the three leagues, I will discuss relevant research related to the topics in this paper and discuss how my research adds to these ideas as well as discuss the methodology and overview of the calculations presented in the results section before presenting the findings of my research.

Literature Review

While little research has been done on the specific organizational differences that lead to income differences in professional sports leagues, as my paper does, much work has been devoted to the relationship between the use of the salary cap and competitive balance. Recall that the primary objective of the salary cap was the equalize win percentages of teams in the league. The focus of many studies has therefore been to determine how effective the policies have been in improving competitive balance, which is closely related to income distribution if contract values represent a true market value of labor that reflects player skill. One such study is titled "The Combined Effect of Salary Restrictions and Revenue Sharing in Sports Leagues" by Dietl, Helmut, Lang, and Rathke. In order to derive which combination of revenue sharing and a salary cap are ideal for a league, this paper began with the benchmark case of two profit maximizing firms in a league

structure with no binding salary cap or floor and introduced a basic revenue sharing model to mathematically examine the impact on team revenues, win percentages, and cost of labor. By assuming that firms are profit maximizers and modeling revenue as a function of market size, team win percentage, and competitive balance, the authors were able to prove the impact of a revenue sharing model on the revenue determinants listed above for both teams in this simplified model. The paper then changed the assumptions for league organization, introducing a binding (hard) salary cap or floor or both and then introducing revenue sharing to determine the outcome on both teams.

After examining the impact on four different structures, the paper concluded that under a regime in which there is no salary cap or salary floor, the introduction of revenue sharing as no effect on competitive balance, supporting the long established idea of the "invariance principle" which states that talent distribution and therefore competitive balance is solely determined by team revenue regardless of other factors (Rottenberg). This principle does not hold, however, when revenue sharing is combined with some form of a salary cap or floor, as competitive balance and firm profits are affected. According to their proofs, the introduction of a salary cap indeed does raise the revenues of smaller market teams while increasing competitive balance, but reduces league profits. In this system, the introduction of revenue sharing works to relocate talent and decrease the cost per unit of labor on average. My paper will add to the work done in this paper by seeing if the proofs done by the authors hold up in practice in leagues using both a binding and non-binding salary cap in tandem with a revenue sharing model.

Taking a more analytical rather than theoretical approach, "Does a Salary Cap Improve Competitive Balance?" by Endo, Florio, Gerber, and Sommers, seeks to statistically measure competitive balance in the NBA pre and post introduction of the salary cap in 1984 to determine if the cap was successful in increasing competitive balance. By using a ratio of cumulative percent of games in in a season to cumulative percentage of teams, the authors developed a GINI index that measured competitive balance rather than income equality and applied it to the NBA. These values

were then computed in a regression model with the coefficient “cap” serving as a proxy variable for years in which the salary cap was in place. The authors hypothesized that the coefficient of this variable would be negative, meaning that during the years the salary cap was in place in the NBA the outcome variable (competitive balance) would be closer to zero which represents perfect equality. Contrary to the hypothesis, however, competitive balance decreased in the years following the introduction of the salary cap as shown by a positive coefficient for the variable “cap”, though it was not statistically significant at the 5% level.

The authors attributed this puzzling relationship to the nature of the “soft” cap system in the NBA, which I explained in the previous section, in which the salary cap is much more fluid that what was assumed in the model presented by the authors in the previous paper that I discussed. Similar to this paper, my paper will use the GINI index as a measure of league parity though through the context of income equality rather than win percentage equality. Furthermore, my paper will add to the work done in this paper by seeking to explain how the soft cap system may have contributed to increased variance in win percentages in the NBA.

Data Overview

Data analyzed in this paper was taken from the independent sports metrics database Spotrac, which compiles statistics over a wide variety of contractual and skill related variables for all major American sports leagues . For each league, I gathered the salary of every player from the 2010-2015 seasons and computed a logarithmic value of each salary. Due to the wide variance between the highest paid and lowest paid player in the league and the bottom heavy, or fat left tail, distribution of salaries I used a logarithmic value to normalize the distribution and make comparison between the three leagues easier. As discussed in the previous section, MLB, the NFL, and the NBA, all have a rookie minimum salary requirement which serves as the minimum wage for the league. Any player with a salary below this requirement represents a player that was not on the team roster for the duration of the season, was signed for a specified number of games, or was cut from the team. The

salaries of these players were not included in any calculations shown in this paper, as they do not give an accurate picture of the true compensation in the league and would skew the data. The table below gives a brief overview of descriptive statistics for the timeframe examined in this paper including the number of players for which salaries were analyzed each year, the average league salary in the given year (Mean Salary), the salary of the highest paid player that year (Top Salary), and the mandated minimum salary in the given year (Minimum Wage) as designated by the Collective Bargaining Agreement of each league.

Descriptive Statistics	2010	2011	2012	2013	2014	2015
NFL						
# Players	1645	1885	2034	1705	1684	1644
Mean Salary	$2,030,648.55	$1,840,499.52	$1,805,379.01	$1,995,827.45	$2,163,483.33	$2,351,365.37
Top Salary	$19,700,000.00	$17,818,000.00	$20,500,000.00	$20,850,000.00	$22,412,500.00	$23,800,000.00
Minimum Wage	$320,000.00	$375,000.00	$390,000.00	$405,000.00	$420,000.00	$435,000.00
MLB	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
# Players	830	839	848	815	802	866
Mean Salary	$3,278,746.83	$3,318,838.25	$3,458,421.22	$3,723,344.35	$3,980,445.91	$4,220,201.38
Top Salary	$33,000,000.00	$32,000,000.00	$30,000,000.00	$29,000,000.00	$26,000,000.00	$32,571,429.00
Minimum Wage	$400,000.00	$414,000.00	$480,000.00	$480,000.00	$500,000.00	$507,500.00
NBA	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
# Players	449	504	538	390	434	442
Mean Salary	$4,700,501.45	$4,443,151.43	$4,195,031.46	$4,972,155.66	$4,811,639.79	$4,801,939.40
Top Salary	$24,806,250.00	$25,244,493.00	$30,453,805.00	$30,453,805.00	$23,500,000.00	$25,000,000.00
Minimum Wage	$457,588.00	$473,604.00	$473,604.00	$490,180.00	$507,336.00	$525,093.00

[1]

The variance in the number of players examined each year is due primarily to fluxuations in the number of players brought in and out of the league due to injuries, rules changes, the structure of player contracts for a given team, or years directly following the introduction of a new Collective Bargaining Agreement. While all three leagues dictate a minimum amount of players that can be on a team's roster as well as a maximum, the gap between these two allows teams to drop or cut players or structure contracts in a way that pays some players more than other years at the expense

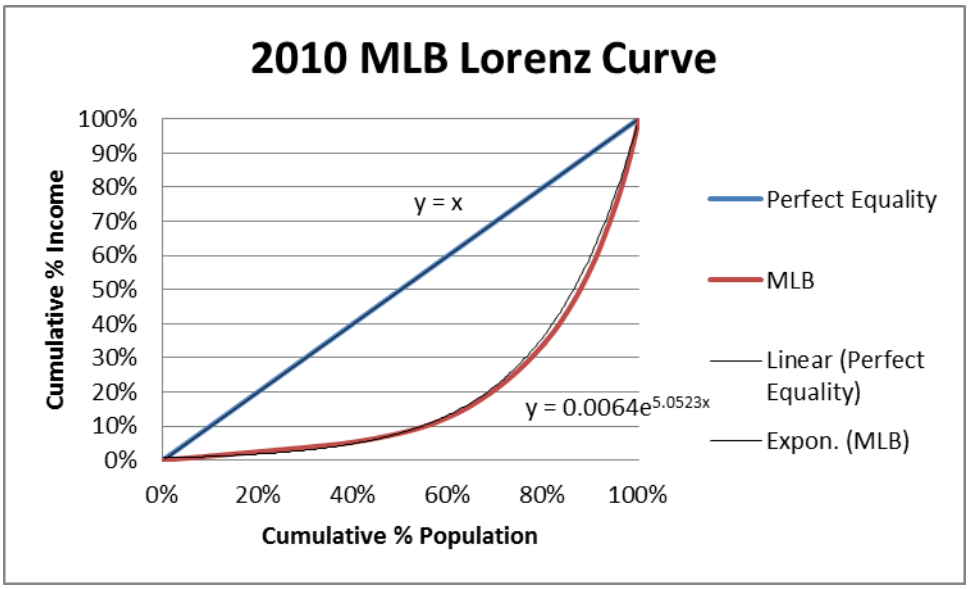
[1] The large increase in NFL players from 2011-2012 is due to the implementation of a new CBA, the year before which teams often allow themselves more space to sign new players under the potential new contract rules, while the number of players smoothed out in the following years.

of having perhaps one or two less players on the roster. Furthermore, the introduction of a Collective Bargaining Agreement, or a league wide set of rules covering every aspect of the sport that is negotiated between the league's labor union and team owners, has the potential to impact both roster size and resource allocation depending on the nature and degree of changes from the previous agreement. The largest variance in the number of players from year to year are in the NFL from the 2011-2012 season and NBA in the 2012-2013 season, both of which are years following the introduction of a new Collective Bargaining Agreement. For the actual measurement of the player salaries themselves, the amount shown is not the "base salary" specified in a player contract but the amount that counts towards the team salary cap in a given year, as this is the true amount of money the player received in a given year as measured by the league. While the exact calculation of this salary varies by league, it is composed almost entirely of base salary and any bonuses received by the player in a given year for all the leagues. As we will see later in the results section, the use of bonuses allows teams to structure contracts in ways that help them maneuver around the salary cap and increase the variance in income distribution in the league, shown here by the non-linear progression in average league salary and top salary for each league, but more on that later.

The main analysis in the following results section revolves around the computation of the variance in the logarithmic values of salaries for both the league, the derivation of the Lorenz Curve of each league, and the calculation of the GINI index. For each league, I calculated a basic league-wide variance in salaries as a basic comparison for the magnitude of dispersion of salaries that allows for a quick measure of income inequality for a league. This metric was also applied to each team in the league, calculating the variance in salaries of every player on each team. To derive the Lorenz Curve, every salary is computed as a percentage of the total sum of salaries in the league to show the cumulative percent of salaries in each league. Each observation, or player, is divided by the total number of observations in the league for that year to obtain the cumulative percent of the population. These two are then plotted against each other against the case of "perfect equality". The perfect equality line shows an income dispersion in which every player receives the same salary, also

the mean salary in the league that year, meaning that every player controls an equal portion of league income. The gap between the perfect equality line and the Lorenz Curve is the graphical representation of inequality in which a curve that deviates more from the perfect equality line represents less equal distribution of wealth. The GINI index is a numerical representation of income inequality that allows for direct comparison. A GINI of 0 represents perfect equality while a GINI of 1 represents perfect inequality, or one person controls all of the income in a given population. From the Lorenz Curve, the GINI index for a given league can be calculated by dividing the area between the line of perfect equality and the Lorenz Curve by the area under the line of perfect equality. More explicitly, the GINI index is the difference between the integrals of the perfect equality line and Lorenz Curve on the interval [0, 1] divided by the integral of the perfect equality line on the interval [0, 1]. For example, we can examine the individual Lorenz Curve of Major League Baseball in 2010 in which the line of perfect equality is shown by the line y=x and the Lorenz Curve is approximated by an exponential function. The resulting GINI calculation is shown next to Table 3.

Table 3



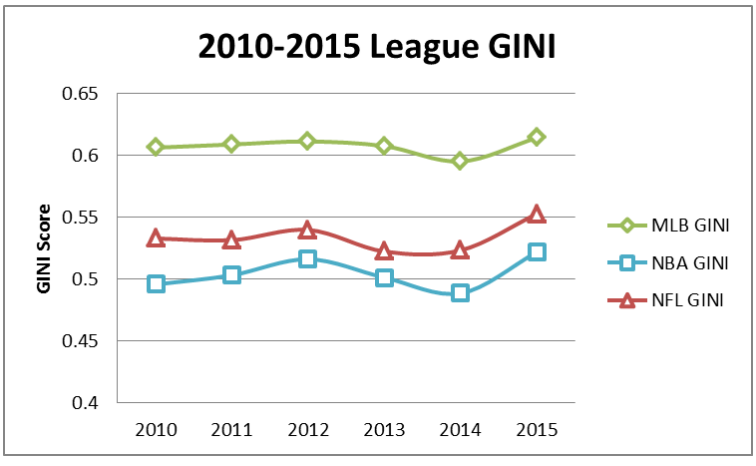
$$\frac{\int_0^1 x\,dx - \int_0^1 0.0064\,e^{5.0523x}\,dx}{\int_0^1 x\,dx} = 0.60634$$

Lastly, to examine exactly where along the Lorenz Curve the greatest variance in salary occurs, I measured the logarithmic dollar differences between income percentiles. For example, in 2010 the salary of the 90th percentile wealthiest player in the NBA was $16.28 in logarithmic terms while the salary of the 10th percentile wealthiest player was $13.54. Thus, the inter-percentile difference in logarithmic terms is $2.78. Examining the differences between percentiles in logarithmic terms will allow me to analyze how portions of the Lorenz Curve of each league compare and examine where exactly along the curve the greatest amount of variance is occurring.

Results and Analysis

In this section, I will show the results of the quantitative analysis between MLB, the NFL, and the NBA, and explore the driving causes of the differences in income inequality. Although the NFL and NBA were statistically quite similar despite having major organizational differences, MLB showed the highest variance in player salaries and highest GINI index for all observed years as well as the highest expected variance in team salaries. While the top and bottom 10% of each league have statistically similar variance, the majority of income variance occurs in the middle 80%, especially in Major League Baseball, where the middle 50% of the league has a much higher variance when compared to the NFL and NBA. To explore this phenomenon in further detail, I will briefly address the possibility that wages have been inflated in Major League Baseball by examining the impact that the League's competitive balance initiatives have had on player salaries. Lastly, I will use the data shown in this section along with the organizational rules of each league to determine which policy decisions have contributed to the level of inequality.

Table 4



As shown in the above chart, Major League Baseball displays the highest absolute level of income inequality as shown by the GINI index for each league in the years 2010-2015. While the NFL displays a slightly higher level of inequality than does the NBA, the two leagues GINI scores in the observed range remain within .0371 of each other, which is a largely insignificant difference in income inequality. The other noticeable observation in this chart is the dramatic rise in the GINI index for each league occurring the 2015 season. This is most likely attributable to the timing of the recent Collective Bargaining Agreements (CBA) for each league. Recall that the CBA is the complete set of league rules that is negotiated between the Players Union in each league and the team owners. While the changes from one CBA to the next are usually subtle, the areas with the most drastic changes generally involve those related to salary allocation such as the calculation of the revenue sharing formula or the calculation of the minimum contract value for each season. As such, owners like to have as much salary cap space and flexibility as possible in the year leading up to the negotiation to accommodate any changes in league policy, and it naturally follows that the years with the most expired contracts are years in which a new CBA is set to be struck. Since the largest amount of contract negotiations with players occur in the year or two following a new CBA, teams have less flexibility to structure contracts in a way that is advantageous for cap space. Recall that for each league a player's income in a year is measured by their base salary and any applicable bonuses. Team owners frequently use the rules regarding bonuses to spread money out over the life of the contract to allow them to maximize cap space in given years, and contracts are often "back loaded" with the majority of a player's bonus being granted near the end of the life of the contract. This means that teams pay less towards the salary cap up front with the hope that they can restructure the contract towards the end of the contract's life in order to maximize the immediate salary cap space available to them. Given that the latest NFL and NBA CBAs were renegotiated in the 2011-2012 season with MLB following suit in 2012-2013, I would attribute the rise in GINI seen in each league in the 2015 season to the increased contract flexibility that owners have following the year or two after the signing of the CBA along with the appearance of the back loaded contract bonuses that

were signed in the new CBA year. This is supported by the decline in GINI for the NFL and NBA in the season directly following the new CBA, 2013, and the decline in GINI for MLB in 2014.

Using data gathered from the Federal Reserve Economic Database (FRED) for 2012, and in line with the analogy of each sports league as an independent economy presented in the introduction to this paper, we can examine where the income inequality of each league ranks in relation to selected countries measured using the same GINI index. Using 2012 data for GINI index, all three leagues would measure in the top 10 most unequal countries in the world, with Major League Baseball being the most unequal country by a small margin over Haiti. The NFL would rank 4th among the most unequal countries between Honduras and Columbia, while the NBA has an income distribution similar to that of Panama. While the difference between the highest paid player in baseball and the lowest paid is only $32,063,929 in 2015, a number which is surely much higher in nearly any given country, the distribution of incomes in heavily skewed to the left in all three leagues, generating a large amount of inequality. In MLB, for example, the top 5% highest paid players control 20.53% of total league income with the 5% lowest paid players controlling 0.53%. Thus, inequality in the leagues is driven much more by the distribution of incomes rather than the gap between the highest and lowest paid players.

Now that we have examined the level of income inequality in absolute terms for each league, we can begin to dissect where exactly along the Lorenz Curve the inequality is coming from. Table 5 shows the trends in income difference for different percentile levels for 2010-2015, as well as the exact GINI index numbers used in Table 4.

Table 5

MLB						
	2010	2011	2012	2013	2014	2015
Variance	1.562651	1.539063	1.539685	1.539685	1.548904	1.622578
CV	0.087987	0.087196	0.086481	0.086481	0.086269	0.088081
1%-99%	3.86	3.88	3.79	3.78	3.82	3.86
5%-95%	3.48	3.49	3.37	3.29	3.43	3.47
10%-90%	3.16	3.17	3.03	2.72	3.17	3.17
25%-75%	2.32	2.31	2.27	1.58	2.30	2.42
GINI	0.6063	0.6089	0.6113	0.6076	0.5952	0.6143
NBA						
	2010	2011	2012	2013	2014	2015
Variance	1.037837	0.985562	1.010113	1.010113	0.898984	1.117285
CV	0.06846	0.066932	0.067263	0.067263	0.063428	0.071146
1%-99%	3.65	3.69	3.71	3.79	3.23	3.75
5%-95%	3.14	3.10	3.20	3.42	2.80	3.40
10%-90%	2.73	2.65	2.66	3.11	2.57	3.18
25%-75%	1.72	1.69	1.62	2.30	1.53	1.70
GINI	0.4958	0.5033	0.5162	0.5014	0.4887	0.5219
NFL						
	2010	2011	2012	2013	2014	2015
Variance	1.038888	0.940529	0.897002	0.897002	0.930656	0.94619
CV	0.073093	0.0699	0.067766	0.067766	0.068674	0.068815
1%-99%	3.66	3.47	3.41	3.44	3.54	3.53
5%-95%	3.15	2.91	2.94	2.94	2.90	2.89
10%-90%	2.70	2.50	2.46	2.42	2.45	2.51
25%-75%	1.64	1.54	1.39	1.42	1.54	1.57
GINI	0.5329	0.5316	0.5399	0.5224	0.5234	0.5528

Unsurprisingly, Major League Baseball displays the highest variance in salaries both by percentiles and absolute terms, with the exception of the NBA in 2013, variance, and coefficient of variation (CV). As hypothesized earlier, we can now conclude that Major League Baseball has the highest income inequality as shown by every statistical measure included in my analysis. It must be the case that a large portion of this variance comes from the structure of the luxury tax system designed by the League. Per the luxury tax, any teams that violate the salary cap imposed by the League are charged a tax on the dollar amount they spend over the cap on a progressive scale. While this offers a strong incentive to avoid breaching the salary cap for a team that does not earn very much revenue, if a team earns high enough revenue to reasonably afford the penalty then that incentive is cancelled. Since 2003, only 6 teams have paid in to the luxury tax and only 3 of those teams paid in more than once (Brown). Thus it can be reasonably assumed that the salary cap is functionally binding for smaller market teams and non-binding for large market teams. The 3 teams mentioned above that repeatedly paid more than the salary cap in a given year were the Yankees,

Dodgers, and Red Sox, who perhaps not so coincidentally, also are the three highest grossing teams in the league. While the revenue sharing program explain previously dictates that all teams pay an equal share of Net Local Revenue and an additional fee or refund based on the team's performance factor, which is designed to force the larger market teams to pay in more than the 34% of Net Local Revenue. However, this system does a poor job of capturing the variance in revenue generated by teams' local television broadcasting rights contracts. In 2013, two MLB teams were tied for a league low $18 million per year local television deal that counts towards Net Local Revenue. This contrasts with the nearly $340 million per year earned by the Los Angeles Dodgers in 2013. It is true that the smaller two teams will receive much more money under the revenue sharing program than will the Dodgers, who will pay a much larger portion of their $340 million than the other two teams will of their $18 million, but it remains that the current CBA does not adequately control for the gigantic variance in local television deals that give larger market teams much more revenue with which they can spend over the salary cap. It should hold then that the highest grossing teams have the highest team variance in salaries as well, as they have more money with which to spend on their best players. Table 6 gives the variance in income for each team in MLB, the NBA, and the NFL, in the 2015 season followed by the average team variance for the 2015. As expected, the Yankees, Dodgers, and Red Sox, the teams who repeatedly paid in to the luxury tax and who have the highest local TV deals in the League, are all in the top 7 teams in the League ranked by highest team variance in salaries.

Table 6

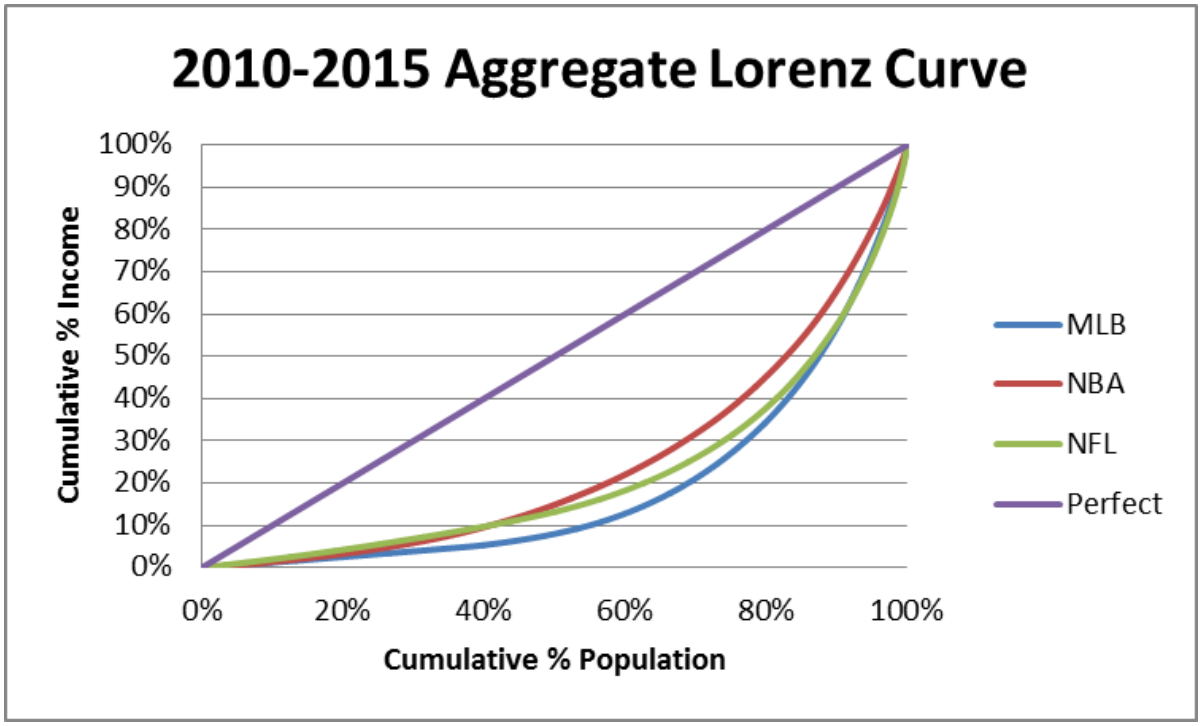
	Var(Income, Team)	E(Income, Team)		Var(Income, Team)	E(Income, Team)		Var(Income, Team)	E(Income, Team)
NFL			**NBA**			**MLB**		
ARI	1.031941634	$ 14.73	Atlanta Hawks	1.274244354	$14.72	Angels	1.861685112	$ 14.51
ATL	0.870127599	$ 14.63	Boston Celtics	0.913949977	$14.59	Astros	1.166770938	$ 14.16
BAL	0.841094529	$ 14.58	Brooklyn Nets	1.0052433	$14.44	Athletics	1.196529431	$ 14.00
BUF	0.931813946	$ 14.71	Charlotte Hornets	1.005484634	$14.94	Blue Jays	1.791579162	$ 14.32
CAR	0.907111831	$ 14.63	Chicago Bulls	1.423205142	$14.75	Braves	1.260935085	$ 14.32
CHI	1.041607532	$ 14.60	Cleveland Cavaliers	1.302131441	$15.31	Brewers	1.813231132	$ 14.29
CIN	0.947738311	$ 14.79	Dallas Mavericks	1.396261076	$14.29	Cardinals	1.733489927	$ 14.48
CLE	0.975923437	$ 14.72	Denver Nuggets	0.599069536	$15.06	Cubs	1.371492346	$ 14.58
DAL	0.841516048	$ 14.66	Detroit Pistons	0.808284052	$14.91	Diamondbacks	1.14241192	$ 13.92
DEN	1.078733345	$ 14.77	Golden State Warriors	1.170475148	$15.27	Dodgers	1.82761468	$ 15.13
DET	0.948900462	$ 14.66	Houston Rockets	1.24238702	$15.16	Giants	1.422149086	$ 15.00
GB	1.057575107	$ 14.76	Indiana Pacers	0.876053826	$14.97	Indians	1.149452769	$ 14.34
HOU	1.068292349	$ 14.77	Los Angeles Clippers	1.574296006	$14.66	Mariners	1.701088269	$ 14.48
IND	0.97075379	$ 14.78	Los Angeles Lakers	1.577412037	$14.73	Marlins	1.26399733	$ 14.32
JAC	1.036591385	$ 14.66	Memphis Grizzlies	1.465163051	$14.85	Mets	1.591426493	$ 14.21
KC	0.941314373	$ 14.57	Miami Heat	1.717497378	$15.05	Nationals	1.716742279	$ 14.82
MIA	1.065777308	$ 14.67	Milwaukee Bucks	0.563801974	$14.79	Orioles	1.29283553	$ 14.64
MIN	0.994291838	$ 14.74	Minnesota Timberwolves	0.678432059	$15.12	Padres	1.535029428	$ 14.54
WAS	0.804133761	$ 14.55	New Orleans Pelicans	1.064478842	$15.11	Phillies	1.907523352	$ 14.24
NE	0.897107712	$ 14.53	New York Knicks	1.122471579	$15.04	Pirates	1.161407136	$ 14.28
NO	0.804886716	$ 14.60	Oklahoma City Thunder	0.858603921	$15.25	Rangers	1.887447479	$ 14.34
NYG	0.920168138	$ 14.80	Orlando Magic	1.089646721	$14.86	Rays	1.127455616	$ 14.10
NYJ	0.905678507	$ 14.65	Philadelphia 76ers	0.779820118	$14.65	Red Sox	1.988415391	$ 14.75
OAK	0.94650157	$ 14.74	Phoenix Suns	1.306107508	$14.49	Reds	1.415381024	$ 14.61
PHI	0.749772013	$ 14.53	Portland Trail Blazers	1.033808295	$14.43	Rockies	1.397753289	$ 14.26
PIT	0.932772752	$ 14.69	Sacramento Kings	0.981706551	$15.11	Royals	1.049600146	$ 14.75

SD	1.117405144	$ 14.74		San Antonio Spurs	1.171979996	$14.80		Tigers	2.171368957	$ 14.79
SEA	0.888929909	$ 14.53		Toronto Raptors	1.199679101	$14.61		Twins	1.59480724	$ 14.49
SF	0.992955832	$ 14.74		Utah Jazz	0.755933455	$14.58		White Sox	1.572084396	$ 14.43
STL	0.826439102	$ 14.62		Washington Wizards	0.54014684	$15.23		Yankees	2.12364867	$ 14.94
TB	0.787408964	$ 14.56								
TEN	0.935770114	$ 14.64								
	E[var(income,team)]	Var[E(income,team)]			E[var(income,team)]	Var[E(income,team)]			E[var(income,team)]	Var[E(income,team)]
	0.939407345	0.006815115			1.083259165	0.074946298			1.541178454	0.082833114

The data presented above paints a clear picture that Major League Baseball has a much higher level of variance in the salaries that it pays its players than do the NFL and NBA. The luxury tax system was designed to discourage large market teams from dominating the labor market while the performance factor portion of the revenue sharing program seeks to further level the playing field by reducing the variance in available revenue between the most profitable and least profitable teams. However, the 2012 MLB CBA failed to adequately address the monstrous growth in local television contracts, which has given the highest earning teams in the league extra revenue that in turn changes the incentive for these teams from avoiding spending over the salary cap to breaching the salary cap and simply paying the relatively cheap luxury tax. In this case, the wealthiest teams in the league effectively remove the price ceiling on labor that the League imposes, allowing them to pay the best players in the League closer to what their true market value of labor might actually be. From the work presented by Totty, Evan S., and Mark F. Owens, we know that teams act as win maximizers up to the point that their budget constraint allows. The lack of a binding salary cap in MLB effectively raises the artificial ceiling placed on teams' budget constraint, allowing them to spend more on labor to maximize wins. If the richest teams in the League are then able to spend more on top talent that is closer to their market value, or at least are willing to outspend less wealthy teams in order to attract top talent, then the market value of players of a similar skill level is raised across the League in order for the less wealthy teams to compete for talent. What remains is a small portion of the wealthiest players controlling an increasing portion of the income in the League as bigger and bigger contracts force smaller market teams to pay their best players more, leaving less money for mid-tier and lower-tier players, thus increasing the income inequality. We can easily see where exactly along the Lorenz Curve this compounding inequality occurs by plotting the

aggregate Lorenz Curves for all three leagues from 2010-2015 using inflation adjusted salaries, shown in Table 7.

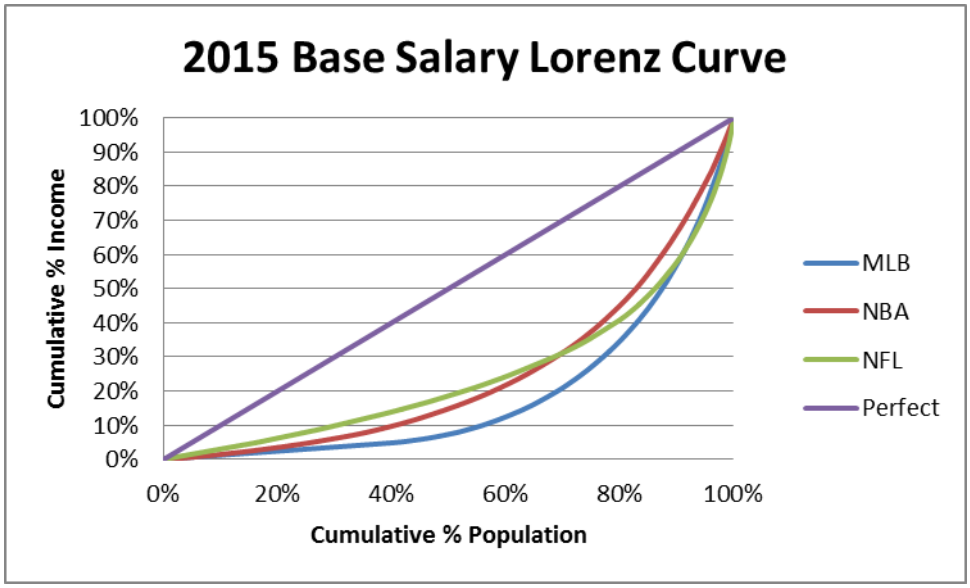
Table 7



As previously stated, the level of inequality for all three leagues is quite similar on the top and bottom portion of the curve, meaning that the bottom 20% of each league and top 10% of each league control comparable amounts of total league income in comparison to each other. The widest gap between the leagues, however, occurs in the middle 50% of the curve in the 25%-75% percentile. From Table 5, I showed that the gap in income between the 75th percentile wealthiest player and 25th percentile wealthiest player was 1.57 for the NFL and 1.70 for the NBA in logarithmic terms, while the same value for MLB was 2.42. With the exception of the 2013 season, this observation holds for every year analyzed in this paper. I would argue that this relatively large gap in income compared to the NBA and NFL is the result of the higher-tier players in MLB being paid exponentially more than mid to low tier players as the result of potentially inflated wages or fairer market values of labor brought about by the soft salary cap system in Major League Baseball.

From this conclusion, I expected the NBA to show a higher level of income inequality than the NFL given that the NBA has a similar soft salary cap and luxury tax system to that of MLB; however the data above refutes this hypothesis. Interestingly, the NFL has the lowest average variance in team income variances as shown in Table 6 as well as the lowest variance in average team salaries by a wide margin (.0068 for the NFL, .0749 for the NBA, .0829 for MLB). This means that on a team by team basis the distribution of wealth is relatively equal in absolute terms and compared to the other leagues, yet the NFL has a higher GINI index for 2010-2015. Due to the fact that the NFL has a hard salary cap that places a stop on the maximum variance in salaries, I expected the NFL to have the lowest GINI index. Recall that the amount an individual player's compensation counts towards the salary cap in each league includes base salary and any applicable bonuses. The NFL allows teams to prorate the bonus over the life of the contract regardless of when the money is received. For instance, if a player signs a new contract for 5 years that includes a $10 million bonus, the player may receive all of that $10 million in the first year of the contract in addition to the base salary specified in the contract. However, the amount that counts towards the teams salary cap would only be the base salary and $2 million of the bonus, as it is spread out equally over each year of the contract. This provision allows teams to advantageously use bonuses to avoid going over the salary cap in a given year, and is attractive for players because they get more of their contract money up front. To analyze the effect of the use of bonuses on the GINI index of each league, I used only the base salary and not any bonuses for each league in order to calculate a new GINI and Lorenz Curve, the results of which can be found in Table 8.

Table 8



Notice that for Major League Baseball and the National Basketball Association, the Lorenz Curve does not change much from the original Curve shown in Table 7. This is not surprising given the minimal use of bonuses in these two leagues. In 2015, only 6 players in the NBA and 102 players in MLB had some form of bonus contributing to their cap hit number, representing 1.3% and 11.96% of players in the leagues, respectively. This compares to the much higher use in the NFL, in which 75.39% of players in the League received some form of bonus in 2015. It should not be surprising, therefore, that the largest change in GINI when only including base salary occurs for the NFL. Major League Baseball remained the most unequal of the Leagues with a mostly unchanged GINI index. The NBA GINI index for base salary in 2015 is .50885, a change of .01305 from the total salary cap GINI calculated in Table 5. The NFL recorded the largest change in GINI, down from .5528 to .50388 when changing the calculation to only include base salary. While the changes in the NBA and MLB were unsubstantial, a change of nearly .05 in the GINI index is significant; especially considering it is not a year to year change but merely a calculation change. The new NFL GINI index then is the lowest of the three leagues, though by a very narrow margin over the NBA. From this significant change in GINI, it holds that the NFL has a higher GINI index than does the NBA due to the use of contract bonuses being distributed over the life of the contract, meaning that a team's salary cap number in a given year may not be the true amount of money being paid in that year.

Conclusion

The results of this paper show that by every statistical measure included in this paper including GINI index, variance of league salaries, average team variance of salaries, and GINI index of base salary, Major League Baseball has the least equitable dispersion of income between the NFL, NBA, and MLB. The driving cause of this relatively high level of income variance is due to the nature of the luxury tax system and the ballooning growth of local television contracts, which has granted large market teams the ability to pay top players substantially more in violation of the salary cap with little regard for the luxury tax penalty, thus driving up the cost of labor for other teams as well.

The NBA had the greatest level of income parity in terms of GINI index due largely to its employment of a salary cap on individual salaries, thus reducing the potential variance between the highest and lowest paid players for players of similar league experience, and its use of salary cap exceptions in favor of small teams that allow them to sign larger contracts in violation of the salary cap without fear of the luxury tax penalty. The NFL showed surprisingly low levels of variance among teams and low variance among the average salary of each team, yet still had a higher GINI index than did the NBA for 2010-2015. This unexpected variance can be controlled for by recalculating the GINI index to only include a player's base salary rather than the total amount contributing to the salary cap, as teams in the NFL have a large incentive to grant large bonuses because of the accounting benefits it garners in relation to the salary cap. When looking at the base salary GINI, the NFL and NBA have virtually equal levels of income inequality.

While this paper examined the impact of a salary cap and revenue sharing on income inequality, it is important to note that the stated objective of these initiatives was to increase competitive balance in the leagues rather than income balance. An analysis of income balance makes for an interesting alternative measure of competitive balance, however, when assuming that team owners attempt to maximize wins through spending on labor within the constraints of their budget. The research in this paper is complimented by the work of several other papers that analyze the impact of a salary cap on the variance in win percentages in order to measure competitive balance, and a side by side analysis of the variance of win percentages and the variance of salaries would provide a better picture of how effective or ineffective these measures have been. The calculations in this paper would then need to be compared to years before the salary cap or revenue sharing were introduced into the leagues in order to fully analyze how the allocation of wins and salaries has changed with new CBAs. This research could be taken a step further by calculating a skill adjusted salary for MLB players. In this paper I introduced the idea that the rapid growth of local television contracts have led to increases in the salaries of top talent in Major League Baseball. While this is undoubtedly part of the puzzle, it could also be the case that rather than reflecting a

better market value of labor for players, salaries have simply been inflated in MLB by large market teams who outprice their small market competitors by offering contracts that exceed what the fair market value for similarly skilled players is. In order to test for this possibility, player salaries would have to be collected in tandem with a proxy variable for player skill in the corresponding year. If after controlling for other salary determinants such as years of experience and position there exists a significant gap between the regression prediction for salary based on skill and the observed results of top players, it might be the case that wages have indeed been inflated. While the research in this paper is not complete in its analysis of change over time, it offers a strong foundation for comparison between leagues that compliments the large volume of work analyzing competitive balance in each league. Given that exclusive television contracts have become such a lucrative business for sports leagues, the demand for which is driven largely by indifferent viewers wishing to see a contested game (Késenne, Stefan, Koning, and Ruud), the issue of competitive balance and by extension income inequality will become an increased point of focus for sports leagues competing over viewers and revenues.

References

Brown, Maury. "Breaking Down Over $400 Million In MLB Luxury Tax Penalties Since 2003." Forbes.Com. 3 Dec. 2015. Web. 22 Mar. 2016.

Coon, Larry. "2011 NBA Collective Bargaining Agreement." CBAfaq.com. Web. 22 Mar. 2016

Dietl, Helmut M., Markus Lang, and Alexander Rathke. "The Combined Effect Of Salary Restrictions And Revenue Sharing In Sports Leagues." *Economic Inquiry* 49.2 (2011): 447-463. *Academic Search Complete*. Web. 22 Mar. 2016

Endo, M., K. Florio, J. Gerber, and P. Sommers. 2003. "Does a Salary Cap Improve Competitive Balance?" Atlantic Economic Journal, 388.

Késenne, Stefan, and Koning, Ruud. New Horizons in the Economics of Sport Series : Economics of Competitive Sports. Cheltenham, Glos, GBR: Edward Elgar Publishing, 2015. ProQuest ebrary. Web. 22 March 2016.

[MLB Data]. (2010-2015 Contract Breakdown by Year.) *Spotrac.com*. Web.

[NBA Data]. (2010-2015 Contract Breakdown by Year.) *Spotrac.com*. Web.

[NFL Data]. (2010-2015 Contract Breakdown by Year.) *Spotrac.com*. Web.

Rottenberg, S. 1956. "The Baseball Players' Labor Market." *Journal of Political Economy*, 64: 242-258.

Thurm, Wendy. "The Marlins and the MLB Revenue Sharing System." *FanGraphs.com*. 14 Nov. 2012. Web. 22 Mar. 2016.

Totty, Evan S., and Mark F. Owens. "Salary caps and competitive balance in professional sports leagues." *Journal for Economic Educators* 11.2 (2011): 46-56.

Vega, Alejandro. “The Impact of Heterogeneity on Team Performance". 2015.

Vrooman, J. 2009. “Theory of the Perfect Game: Competitive Balance in Monopoly Sports Leagues.” *Review of Industrial Organization, 34(1): 5-44.*

Zepfel, Evan. "Have MLB’s Efforts to Preserve Competitive Balance Done Enough?" *Harvardsportsanalysis.org*. 13 Feb. 2015. Web. 22 Mar. 2016.