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Abstract: We examine the evolution of salary distribution in the National Basketball Association (NBA) over 33 years, using a panel of all players earning above the rookie minimum scale. We identify three distinct eras of salary dynamics by applying time series structural break analysis, with breaks aligned to key changes in NBA Collective Bargaining Agreements. Our findings show that while real salaries have risen substantially across all income levels, inequality has grown, particularly among the highest earners. Analyzing the Lorenz curve and Gini coefficient, we observe a period of increasing inequality during the 1990s, followed by a brief shift toward more equitable salary distribution in the early 2000s and a return to rising inequality in recent years. These insights reveal the complex interplay between union negotiations, league revenues, and market forces, offering a deeper understanding of how CBA policies have shaped salary distribution in professional sports.

JEL classification: Z22, L83

Keywords: Unions, Collective Bargaining Agreement, NBA, Structural Breaks Analysis

*We dedicate this article to Mark Stazicich who lost his battle with cancer before completion of the article.

Over the last three decades, the National Basketball Association (NBA) has experienced significant growth in both total revenues and player salaries. Between the 1990-91 and 2021-22 seasons, real total revenues increased by 475%, rising from $1.95 billion to $11.24 billion.[1] This surge in revenue has led to substantial salary growth across all levels of players, with the median salary increasing by 199% and the mean salary by 370% over the same period. While salaries have increased across the board, we find that some players have benefited more than others, raising questions about the changing distribution of earnings within the league.

This paper explores how salary inequality in the NBA has evolved over time, particularly in response to changes in the league's Collective Bargaining Agreements (CBAs). Using salary data spanning from the 1990-91 season to the 2021-22 season, we apply time series structural break analysis to identify shifts in the mean and median salaries and the Gini coefficient, which measures income inequality. These structural breaks correspond closely with key changes in CBAs, reflecting how the power dynamics between players and team owners have influenced salary distribution. The NBA offers a unique context for examining labor market dynamics due to the high level of unionization and the central role of collective bargaining in determining player compensation. Historically, CBAs have shaped the distribution of salaries by regulating issues such as free agency, salary caps, and revenue sharing. These agreements reflect the evolving balance between the players' union's monopoly power to negotiate higher wages and the league's efforts to control costs.

Our analysis reveals three distinct eras of salary distribution in the NBA. The first era, spanning the 1990-91 to 1997-98 seasons, is marked by rising inequality as unions fought for free agency, leading to rapid salary increases for top players. The second era, from 1997-98 to

[1] All Revenue and Salary measures are reported in 2023 dollars.

2009-10, shows a modest reduction in inequality as lower-tier players saw their share of total salaries increase. However, the third era, from 2009-10 to 2021-22, saw a resurgence of inequality, with top-tier players capturing a larger share of the growing revenue pool.

The paper contributes to the literature on industrial relations, labor markets, and sports economics by providing new insights into the long-term effects of union negotiations and revenue growth on salary distribution. By identifying structural breaks in salary trends, we highlight the complex relationship between collective bargaining and salary inequality in professional sports. In doing so, we offer broader lessons for labor markets where collective bargaining plays a key role in wage determination.

This paper is structured as follows: In section 2, we provide a historical context to the various CBAs over our time period and a literature review of the various studies on the influence of CBAs on wages. In section 3, we employ unit root tests with structural breaks to identify changes over time in the mean and median salary, Gini coefficient, and total revenues and how the identified breaks align with historical events. Section 4 analyzes changes in the Lorenz curve from the first to last year in each era. We conclude in section 5 with several predictions on future CBAs in a rising tide of revenues.

2. Literature Collective Bargaining Agreements

The interplay between team owners and the players' union determines salaries in the NBA. At the beginning of the NBA, the owners used a reserve clause to keep each player assigned to one team. This arrangement provided monopsony power for owners to exploit players and keep their salaries low. (Hill and Jolly 2012). The NBA players' union is a monopoly that negotiates higher salaries for its players. (Freeman and Medoff 1984). Thus, salaries in the

NBA are determined in a bilaterial monopoly. In a bilateral monopoly work stoppages of either a strike or lockout are common.

Unions, however, have two faces (Freeman and Medoff 1984). First is the monopoly face where unions negotiate for higher wages for all their workers. Blanchflower and Bryson (2004) find the union wage premium at about 18 percent. Budd and Na (2000) using a ten-year panel find a 12% to 14% premium for workers covered by a CBA. Dobbelaere et al. (2024) find in using German data wage markdowns are significantly smaller when organized labor is present and labor market imperfections are present.

Unions, however, also have a collective voice that occurs because of the political process, so the median voter model applies. Suggesting that unions maximize the benefits of the median voter (Freeman and Medoff 1984). White (1982) finds that median voters in the union's internal wage structure benefit the median voters the most. In addition, unions have traditionally compressed salary differences associated with worker productivity-related salaries and differences based on seniority and other non-productivity-related characteristics (Black and Parker 1985). Parsons (1992) suggests that the rational self-interested model has aspects of an egalitarian nature, where union members vote for contracts that benefit the lower end of the wage distribution.

Focusing on the NBA, both Hill and Groothuis (2001) and Hill and Jolly (2012) found that CBAs in the NBA have followed this same pattern as in other industries by increasing wages for the median voter at the expense of both superstars and rookies. Turner and Hakes (2007) using quintile regression for all first-round draft picks show the earliest draft picks suffer the highest rent transfer. Ducking, Groothuis, and Hill (2014) show that owners do not replace higher-paid seniority workers with lower-paid, less seniority workers because of aspects of the

CBA. Kaplan (2024) discovered that the most talented players subsidize less talented players. Their findings suggest that the most talented players generate significantly more value to the NBA than their actual and expected salaries.

Six collective bargaining agreements apply to our analysis in our time series: the 1988 CBA, the 1995 CBA, the 1999 CBA, the 2005 CBA, the 2011 CBA, and the 2017 CBA. Our research question is: Has the importance of the monopoly model of unions and the median voter model changed over time? We use structural break analysis to test this question.

2. Time Series Tests and Structural Breaks

Time series econometrics can provide a unique way to gain new insights in many fields of investigation. In sports, historians and others often assume *exogenous* changes in a time series based on certain historical events. In contrast, in the present paper, we make no prior judgments about the timing of any breaks. Instead, we utilize time series tests to let the data *endogenously* identify different eras and use these eras to examine salary distributions in the NBA. By doing so, we hope to identify changing eras in the NBA that may not be apparent when focusing *a priori* on particular historical events.

Utilizing time series tests to analyze sports data has become more popular in the literature. For example, Fort and Lee (2006, 2007), Lee and Fort (2005, 2008, 2012), and Mills and Fort (2014) employ unit root and structural break tests to examine competitive balance in a variety of sports. More recently, Groothuis et al. (2017) used similar tests to measure changing performance eras in Major League Baseball (MLB), and Depken et al. (2020) identified structural breaks in four traditional National Hockey League (NHL) performance measures. They

compared these with structural breaks in four measures of penalties and fighting.[2] In the present paper, we adopt a similar approach in a different context and examine time series on the real mean and median salaries, the Gini coefficient, and real total revenues in the NBA.

Methodology

We begin by performing unit root tests to determine if our time series are non-stationary. A non-stationary time series is described as having a "stochastic trend," where there is no tendency to revert to a stable trend (or mean) following a shock. A non-stationary time series behaves as a random walk. In contrast, a stationary time series is described as having a "deterministic trend," where the series reverts to a stable trend (or mean) following a shock. Unit root tests can be performed for each series to test for non-stationarity, where failure to reject the null hypothesis implies that the time series is non-stationary and has a stochastic trend.

Following Perron and Vogelsang (1992), it is well known that ignoring an existing structural break in unit root tests will reduce the ability to reject a false unit root null hypothesis. To overcome this drawback, we utilize the endogenous one- and two-break LM unit root tests proposed by Lee and Strazicich (2003, 2013), which test for a unit root while jointly searching for and including one or two structural breaks. While one might consider the Zivot and Andrews endogenous break unit root test (1992, ZA hereafter) and other similar Augmented Dickey-Fuller (ADF) endogenous break type tests, the Lee and Strazicich test has the desirable property that its test statistic is not subject to spurious rejections.[3] As a result, conclusions are more reliable since

[2] See also the works of Scully (1995), Palacios-Huerta (2004), Schmidt and Berri (2004), and Nieswiadomy et al. (2012).

[3] See Nunes, Newbold, and Kuan (1997) and Lee and Strazicich (2001) for further discussion on the spurious rejection problem in endogenous break ADF type tests.

rejecting the null hypothesis unambiguously implies that the time series is stationary around one or two breaks in the level and/or trend.[4]

Our testing methodology can be summarized as follows.[5] According to the LM "score" principle, the test statistic for a unit root can be obtained from the following regression:

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + \Sigma \gamma \Delta \tilde{S}_{t-i} + \varepsilon_t, \qquad (1)$$

where $\tilde{S}_t = y_t - \tilde{\psi}_x - Z_t\tilde{\delta}$, $t=2,..,T$, $\tilde{\delta}$ are the coefficients from the regression of Δy_t on ΔZ_t, and $\tilde{\psi}_x$ is the restricted MLE of ψ_X $(\equiv \psi + X_0)$ given by $y_1 - Z_1\tilde{\delta}$. $\Delta\tilde{S}_{t-i}$ terms are included as necessary to correct for serial correlation, ε_t is the contemporaneous error term assumed to be independent and identically distributed with zero mean and finite variance, and Z_t is a vector of exogenous variables contained in the data generating process. Z_t is described by $[1, t, D_{1t}, D_{2t}, DT_{1t}^*, DT_{2t}^*]'$, where $D_{jt} = 1$ if $t \geq T_{Bj} + 1$, $j = 1,2$, and zero otherwise, $DT_{jt}^* = t$ if $t \geq T_{Bj} + 1$, and zero otherwise, where T_{Bj} is the time period of the structural break. Note that the testing regression (1) involves ΔZ_t instead of Z_t, where ΔZ_t is described by $[1, B_{1t}, B_{2t}, D_{1t}, D_{2t}]'$, $B_{jt} = \Delta D_{jt}$, and $D_{jt} = \Delta DT_{jt}^*$, $j=1, 2$. B_{1t} and B_{2t}, and D_{1t} and D_{2t}, correspond to structural changes or breaks in the level and trend under the (stationary) alternative, and to one period jumps and permanent changes in the drift under the (unit root) null hypothesis, respectively. The unit root null hypothesis is described by $\phi = 0$ and the LM test statistic is defined by:

$$\tilde{\tau} \equiv \text{test statistic testing the null hypothesis } \phi = 0. \qquad (2)$$

[4] By "structural break," we imply a significant but infrequent, permanent change in the level and/or trend of a time series. See Enders (2010) for additional background discussion on structural breaks and unit root tests.

[5] Gauss codes for the one- and two-break minimum LM unit root test are available at https://sites.google.com/site/junsoolee/codes and https://strazicichmc.weebly.com.

To endogenously determine the location of two breaks ($\lambda_j = T_{Bj}/T$, j=1, 2), the LM unit root test uses a grid search to determine the combination of two break points $\lambda = (\lambda_1, \lambda_2)'$ over the interval [.1T, .9T] (to eliminate end points), where the test statistic is minimized. Since the critical values for the model with trend-break depend on the location of the breaks (λ_j), we employ critical values corresponding to the location of the breaks.[6]

To determine the number of lagged augmented terms $\Delta\tilde{S}_{t-i}$, $i = 1,..,k$, to correct for serial correlation, we employ a "general to specific" procedure. At each combination of two break points we begin with a maximum number of k = 4 lagged terms and examine the last term to see if its t-statistic is significantly different from zero at the 10% level (critical value of 1.645 in an asymptotic normal distribution). If insignificant, the k = 4 term is dropped and the model is re-estimated using k = 3 terms, etc., until the maximum lagged term is found, or k = 0. Once the maximum number of lagged terms is found, all lower lags remain in the regression.[7] The process is repeated for each combination of two break points to jointly identify the breaks and the test statistic at the point where the unit root test statistic is minimized.

Results

Test results are reported in Table 1 for the real mean salary (MEAN) and median salary (MEDIAN), Gini coefficient (GINI), and real total revenues (REVENUE). In each case, we begin by applying the two-break LM unit root test. If only one break is identified (at the 10% level of significance) in the two-break test, we re-examine the series using the one-break LM unit root

[6] While one might consider allowing for more than two breaks in the unit root tests, we do not consider this possibility in the present paper. In particular, the computational burden of allowing for three or more breaks in the unit root test in conjunction with determining the number of first differenced lagged terms would increase significantly.

[7] This type of method has been shown to perform well when compared to other data-dependent procedures to select the optimal k (e.g., Ng and Perron 1995).

test.[8] We first consider the results for real mean salaries. The evidence in Table 1 suggests that the real mean salary time series rejects a unit root and is stationary around two structural breaks, in 1997-1998 and 2009-2010, respectively. Table 2 reports results regression results on the identified level and trend breaks.[9] To better visualize these results, Figure 1 displays plots of the fitted and actual values from the regression in Table 2. From Figure 1, we observe an upward sloping trend that decreases somewhat around the first identified break in 1997-1998. Then, around the time of second break in 2009-2010, the trend steepens significantly. We next consider the results for real median salaries. The evidence rejects the unit root null hypothesis in favor of a stationary time series around one structural break, in 2005-2006. Results of a regression on the identified break is reported in Table 2. Figure 2 displays plots of the fitted and actual values from a regression on the break. We observe that the upward sloping trend of real median salaries decreases somewhat around the time of the break in 2005-2006.

We next consider the results for the Gini coefficient. The evidence rejects the unit root hypothesis and suggests that the Gini coefficient is stationary around two structural breaks in 1997-1998 and 2009-2010, respectively. Results of a regression on the identified breaks is reported in Table 2. Figure 3 displays plots of the fitted and actual values from the regression on the breaks. We initially observe a steep upward sloping trend in the Gini coefficient, indicating rising inequality. However, around the time of our first identified break, in 1997-1998, the slope turns negative indicating that inequality is decreasing. Then around the time of our second identified break, in 2009-2010, the trend in the Gini coefficient becomes positive again, indicating that

[8] If no break is significant (at the 10% level) in the one-break unit root test we could then utilize a no-break unit root test. However, one or two significant breaks were identified in each series.
[9] Given that these series were found to be stationary around breaks, the spurious regression problem found when utilizing nonstationary times series can be avoided.

inequality is rising again, while the upward sloping trend is significantly less than prior to the 1997-1998 season. We next consider the results for total real revenue. The evidence rejects a unit root and supports the alternative hypothesis of a time series that is stationary around two structural breaks in 2014-2015 and 2018-2019, respectively. Regression results on the identified breaks is reported in Table 2. Figure 4 displays plots of the fitted and actual values from the regression on breaks. From Figure 4, we observe a mild upward trend in real total revenues that shifts upward around the time of our first identified break in 2014-2015. Following the time of the second identified break, in 2018-2019, we observe a significant steepening of the upward trend in real total revenues.

Historical events and Structural breaks

In table 3 we identify historical events that correspond to the structural breaks found in our analysis. We find two structural breaks in the revenues time series the first in the 2014-15 season and the second in the 2018-2019 season. The 2014-15 break occurred when the league agreed to a pair of nine-year deals for a combined $24 billion with Walt Disney Co. (home of ABC and ESPN) and what's now Warner Bros. Discovery Inc. (owner of TNT). At $2.7 billion per year, almost triple the annual value of the previous agreements. (Bloomberg 2024). The second break occurred just before the COVID shutdown.

We find that structural breaks in our salary measures occur at or near the changes in the CBA. First, we find that the median salary time series had a break in the 2005 and the 2006 season at the same time as the 2005 CBA. Second, we find that both the mean salary and the Gini coefficient break in 1997-1998 and 2009-2010. The 1997-1998 break occurred one year before the 1998-1999 lockout that lasted six months. During the lockout instead of playing 82 regular season games the NBA only played 50 regular season games before the CBA was agreed upon. The

second structural break occurring in 2009-2010 occurred two years before the 2011-2012 lockout that lasted five months. During the lookout only 66 regular season games were played instead of the 82 scheduled regular season games. Focusing of the structural breaks in the Gini coefficient we identified three distinct eras. The first era occurs from the 1990-1991 until 1997-1998 season where the Gini coefficient show increased inequality. The second era runs from 1997-1998 until 2009-2010 season occurring between the two lockouts. In this era the Gini coefficient shows a slight decline indicating more equality between players. The third era runs from 2009-2010 until the end of our data set of the 2022-23 season. In this era there is a slight increase in the Gini coefficient trend indicating a slight increase in inequality of salaries. To provide additional insights on the changes in salary inequality of the three different eras, we analyze changes in the Lorenz curve between the first and last year of each era in the next section.

6. Analysis of Lorenz Curves

To gain deeper insights into the impact of Collective Bargaining Agreements (CBAs) on salary distribution, we examine the Lorenz curves and Gini coefficients for the first and last years of each identified era. The Lorenz curve, a graphical representation of income or wealth distribution, plots the cumulative percentage of total income earned against the cumulative percentage of recipients. The Gini coefficient, a single-number summary of the Lorenz curve, quantifies the degree of inequality, ranging from 0 (perfect equality) to 1 (maximum inequality).

Era 1: 1990-91 to 1997-98: The Rise of Inequality

A significant increase in salary inequality is observed in the era spanning from 1990-91 to 1997-98. Figure 5 illustrates the Lorenz curves for this era's first and last years. The curve for 1997-98 lies further away from the line of perfect equality compared to that of 1990-91, indicating

a growing disparity in salary distribution. This period coincided with the unions' push for free agency, which likely empowered top-tier players to negotiate higher salaries while lower-tier players experienced fewer substantial gains. This widening gap is also reflected in the Gini coefficient, which increased from 0.414 in 1990-91 to 0.541 in 1997-98.

To analyze if the changes in the Lorenz curves are statistically significant, we use the contrast Lorenz dominance analysis (Jann 2016). In table 4, we find that for each 5th percentile of the Lorenz curve was positive and both statistically and economically significant for showing growing inequality for all levels. Thus the 1997-98 stochastically dominates the 1997-1998 Lorenz curve with all levels showing increased inequality. Focusing on the magnitudes, we find the top end of the distribution has the biggest change with the 55th through the 95th have the biggest change of about .10 for each level. This result is consistent with the monopoly face of unionism with the push for free agency particularly increasing the salaries of the most productive players in the top half of the distribution. In 1990-1991 the revenue split was fifty-fifty between plays and owners. In 1997-1998 players received fifty-seven percent of the revenues while teams received forty-three percent of the income which is consistent with the monopoly face of unions,

Focusing on the rising tide of revenues influence on salaries in Table 5, we show in this first era revenues increased by 84% while salaries increased at very different rates. For instance, the median salary increasing by 66% and the mean salary by 105% indicating an increase skewness towards the superstars at the top of the distribution. Focusing on the different percentiles, we find that the 10th and 25th percentiles growing the least at three percent or below while the 75th, 90th and 95th percentiles growing by over 110%. Superstar salaries grew the most at 258% or three times faster than revenue growth.

Era 2: 1997-98 to 2009-10: A Shift Towards Equity

The second era, spanning from 1997-98 to 2009-10, reveals a subtle yet meaningful shift towards a more equitable distribution of salaries, aligning with the predictions of the median voter model or the collective voice face of unionism. The Lorenz curve for 2009-10 edges closer to the line of equality compared to that of 1997-98 (Figure 6), suggesting a reduction in salary disparities. This development can be attributed to the influence of the collective voice or median voter model on CBAs established during this period, which aimed to mitigate the growing inequality by bolstering the share of total salaries allocated to lower-tier players. This trend is mirrored in the Gini coefficient, which decreased from 0.541 in 1997-98 to 0.524 in 2009-10.

We use the Jann's (2016) analysis as in the first era to identify if the changes in the Lorenz curves are statistically significant. In table 6, we find all percentiles of the Lorenz curve were negative, but many were not statistically nor economically significant indicating lowering inequality that was more pronounced at some levels. Focusing on the statistical significance and magnitudes, we find that there is improved equality for the players in the 15^{th} through 35^{th} percentiles all significant at the 95% and the 10^{th} and 40^{th} significant at the 90% level. In terms of magnitudes none are particularly large indicating on slight improvement in salaries reducing the inequality of earnings.

Lastly, we find that for the 90^{th} percentile was negative and significant at the 90% level and the 95^{th} percentile was negative and significant at the 95% level. Both the 90^{th} and 95^{th} percentiles were somewhat large in magnitudes with a -.04 and a -.06 respectively indicating a reduction of inequality through a reduced salary. The remainder of the percentiles from the 45^{th} through the 85^{th} were all negative but statistically insignificant and low in magnitude indicating that only the low salary players and the highest salary players were affected by the 1998 CBA.

These results are consistent with the collective voice median voter model where there is a redistribution of income from the star players in the 90th and 95th percentile to those in the 10th through the 40th percentile which is consistent with Hill and Groothuis (2001). It is also consistent with a median voter model coupled with an egalitarian nature where union members vote for contacts that benefit the lower end of the wage distribution which is consistent with Parson (1992). In this period the revenue split remained at fifty-seven percent for players and forty-three percent for owners suggesting that the monopoly face of unionization had been diminished.

Focusing on the rising tide of revenues influence on salaries in Table 7, we show in that the second era revenues increased by 55% while salaries increased at similar rates. For instance, the median salary increasing by 63% and the mean salary by 64% indicating there was not increase skewness the distribution towards the top of the distribution. Focusing on the different percentiles, we find that the 5th, 10th, and 25th percentiles growing the fastest which is consistent with median voter model with egalitarian preferences. We also found that the top end of the distribution showed gains of about 90% for both the 90th and 95th percentile. The super stars salaries grew the least at 21% or 32% slower than revenue growth. These results are consistent with Hill and Groothuis (2001) conjecture of a Robin Hood rent redistribution from the rich superstars to the less rich role players.

Hill and Jolly (2012) quoting an unidentified player's agent states "If they cut the highest 25 or 30 salaries by, say, 35 percent, you're not going to have to change that much more for [the owners] to get what they want financially. LeBron can scream and shout all he wants, but this is a one-man, one-vote union. Once guys figure out that 400 or so players will benefit by the top few taking a major cut, what do you think they're going to do?" Showing that stake holders in the CBA negotiations understand the median voter model of unions.

E*ra 3: 2009-10 to 2021-22: The Return of Inequality*

The third era, from 2009-10 to 2021-22, presents a complex landscape where soaring revenues and a hybrid form of unionism led to a pronounced increase in salaries concentrated in the upper echelon of players. The Lorenz curve for 2021-22 reveals a pronounced outward shift in the upper portion compared to 2009-10 (Figure 7), signifying a growing disparity between the highest earners and the rest. This trend suggests a dual influence: while the collective bargaining power of the union secured overall gains for players, the market forces amplified the earning potential of superstars. The Gini coefficient, rising from 0.524 in 2009-10 to 0.647 in 2021-22, quantifies this escalating inequality, reflecting the combined effects of both the monopoly face and collective voice face of unionism. This era underscores the intricate interplay between collective bargaining and market dynamics in shaping salary distribution, where rising tides lift all boats, but some rise far higher than others.

Using Jann's (2016) analysis, we find changes to the Lorenz curves that are positive and statistically significant but only for the top of the income distribution. In table 8, we find that for each of the percentile of the Lorenz curve between the 5^{th} and 45^{th} were statistically and economically insignificant indicating no change in the salary distribution between the second and third eras. The top half of the salary distribution, however, there was an increase in inequality that were all positive and both statistically and economically significant from the 50^{th} percentile through the 95^{th} percentile. The largest magnitudes occurred between the 75^{th} and 90^{th} percentile at about .06 suggesting the top of the distribution gained the most.

Focusing on the rising tide of revenue influence on salaries in Table 9, we find that in the third era, revenues increased by 108% while salaries increased by less than this rate at all levels. The reason salary growth was lower than revenue growth occurred was because, in the CBA, the

players' union agreed to a fifty-fifty split of revenues, lowering the players' share from 57% to 50%. We suggest that owners who own teams for many years have more bargaining power due to their ability to hold out during a lockout while players who have short careers and have no outside opportunities find it too costly to hold which provides the owners with the bargaining power to lower the revenue amount received by players (Sadler and Sanders 2016).

In this period, the median salary increased by 10% and the mean salary by 40%, indicating an increase in skewness where higher salaries of stars skew the distribution towards the top. Focusing on the different percentiles, we find that the 1st, the 90th, and 99th percentile all gained the most at over 60%. In this period, there was a structural break in revenues where the league signed a massive media contract, increasing the amount of revenues available to spend on talent. Given the new revenue stream, the owners have again returned to spending on the superstars.

Conclusion, Overall Trends, and Implications

The analysis of Lorenz curves and Gini coefficients reveals a dynamic landscape of salary distribution in the NBA, shaped by the interplay of CBA policies, economic factors, and league priorities. The initial push for free agency led to increased inequality, followed by a period of relative equity due to CBA interventions. However, the recent surge in revenues and the emphasis on superstar players have exacerbated inequality, highlighting the ongoing challenges in balancing competitive compensation with fair distribution.

These findings offer valuable insights not just for the NBA but for labor markets in highly unionized, high-revenue industries more broadly. The NBA's experience in managing salary distribution, particularly in how collective bargaining agreements (CBAs) can both mitigate and

exacerbate income inequality, can inspire and motivate industry stakeholders to make positive changes in their own sectors.

First, for policymakers involved in CBA negotiations, there is a need to strike a balance between maximizing revenues and maintaining fairness in salary distribution. As the NBA's history shows, unchecked revenue growth tends to benefit the highest earners disproportionately, often leaving lower-tier players behind. This underscores the weight of their decisions and the importance of their role in ensuring that future CBAs could include provisions that better distribute revenue increases across all salary levels, ensuring that rising revenues lift all players, not just those at the top. For instance, salary caps and revenue-sharing mechanisms should be regularly reviewed and adjusted to keep pace with changes in the economic environment. Second, the league could explore strategies such as implementing 'salary floors' or more aggressive luxury taxes to encourage a more equitable pay distribution. Additionally, consideration could be given to limiting the growth of maximum salaries to prevent runaway salaries at the top end of the distribution. Third, labor economists and sports stakeholders should consider the NBA's structural breaks in salary distribution as a case study for industries experiencing rapid technological or market changes. Similar dynamics of unionized labor negotiating for a fair share of exponentially growing revenues may emerge in entertainment, media, and technology.

In summary, the results demonstrate the critical role that collective bargaining plays in shaping salary distribution over time. The rising inequality observed in the NBA's most recent era reflects a complex intersection of market dynamics and union strategies, suggesting that further attention to equitable compensation is needed. These findings offer key lessons for policymakers and stakeholders within professional sports and industries where union negotiations and rapid revenue growth coexist.

Table 1: LM Unit Root Test Results for NBA, 1990-1991 through 2021-2022

Time Series	*Test Statistic*	*Breaks Years*	*k*	*Break Positions*
MEAN	-5.761**	1997-98, 2009-10	3	λ = (.2, .6)
MEDIAN	-4.496*	2005-06	2	λ = (.5)
GINI	-6.781***	1997-98, 2009-10	2	λ = (.2, .6)
REVENUE	-6.637***	2014-15, 2018-19	0	λ = (.6, .8)

Notes: Variables are defined as follows: real mean salary (MEAN), real median salary (MEDIAN), Gini coefficient (GINI), where a higher Gini coefficient denotes greater salary inequality, and real total revenue (REVENUE). Test Statistic tests the null hypothesis of a unit root, where rejection of the null implies a trend-break stationary series. *k* is the number of lagged first-differenced terms included to correct for serial correlation. The critical values for the one- and two-break LM unit root tests come from Lee and Strazicich (2003, 2013). The critical values depend on the location of the breaks, $\lambda = (T_{B1}/T, T_{B2}/T)$, and are symmetric around λ and (1-λ). *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 2: OLS Regressions on Level and Trend Breaks of NBA Real Mean and Median Salaries, Gini Coefficient, and Real Total Revenues, 1990-1991 through 2021-2022

$MEAN_t = 772880+1760305D_{1997}+2465383D_{2009}+168929Trend+1219221T_{1997}+157482T_{2009}\ lags(4)+e_t$
(2.820)** (3.620)*** (3.856)*** (3.164)*** (3.316)*** (4.715)***
$\bar{R}^2 = 0.978$ SER = 258774

$MEDIAN_t = 109484+2258700D_{2005}+157678Trend+35833T_{2005}+lags(3)+e_t$
(4.162)*** (3.148)*** (3.270)*** (2.379)**
$\bar{R}^2 = 0.923$ SER = 202564

$GINI_t = 0.363+0.164D_{1997}+0.127D_{2009}+0.019Trend-0.002T_{1997}+0.005T_{2009}+lags(0)+e_t$
(27.534)***(11.804)***(9.390)***(6.459)***(-4.292)***(11.776)***
$\bar{R}^2 = 0.904$ SER = 0.013

$REVENUE_t = 1.293+6.889D_{2014}-0.349D_{2018}+0.163Trend-0.146T_{2014}+4.544T_{2018}+lags(3)+e_t$
(1.850)* (5.397)***(-0.110) (2.857)***(-0.364) (9.537)***
$\bar{R}^2 = 0.932$ SER = 0.658

Notes: Variables are defined as: real mean salaries (MEAN), real median salaries (MEDIAN), Gini Coefficient (GINI), and real total revenues (REVENUE). D and T represent dummy variables for the identified intercept and trend breaks respectively. TREND denotes a common trend. White's robust standard errors were utilized to control for heteroscedasticity. Lagged values of the dependent variable were included to correct for serial correlation as described in Section 3. SER indicates the Standard Error of the Regression. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Figure 1. NBA Real Mean Salary and Trend with Structural Breaks in 1997-98 and 2009-10.

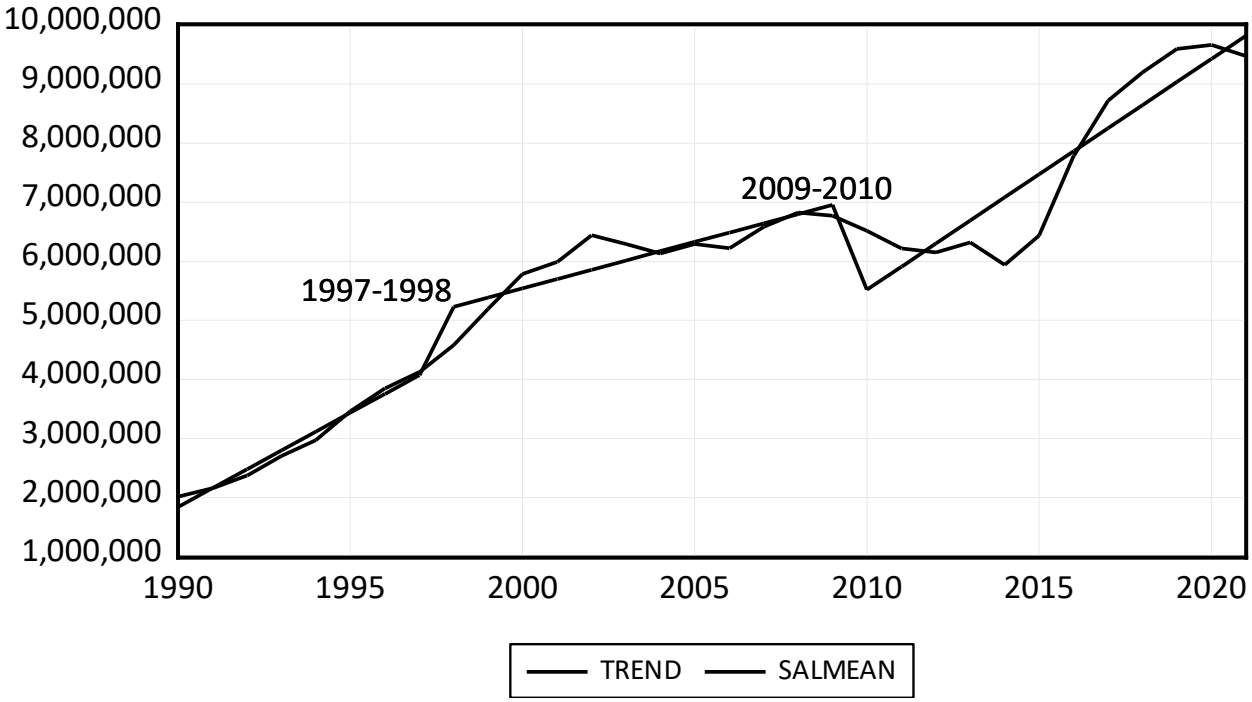

Figure 2. NBA Real Median Salary and Trend with a Structural Break in 2005-06.

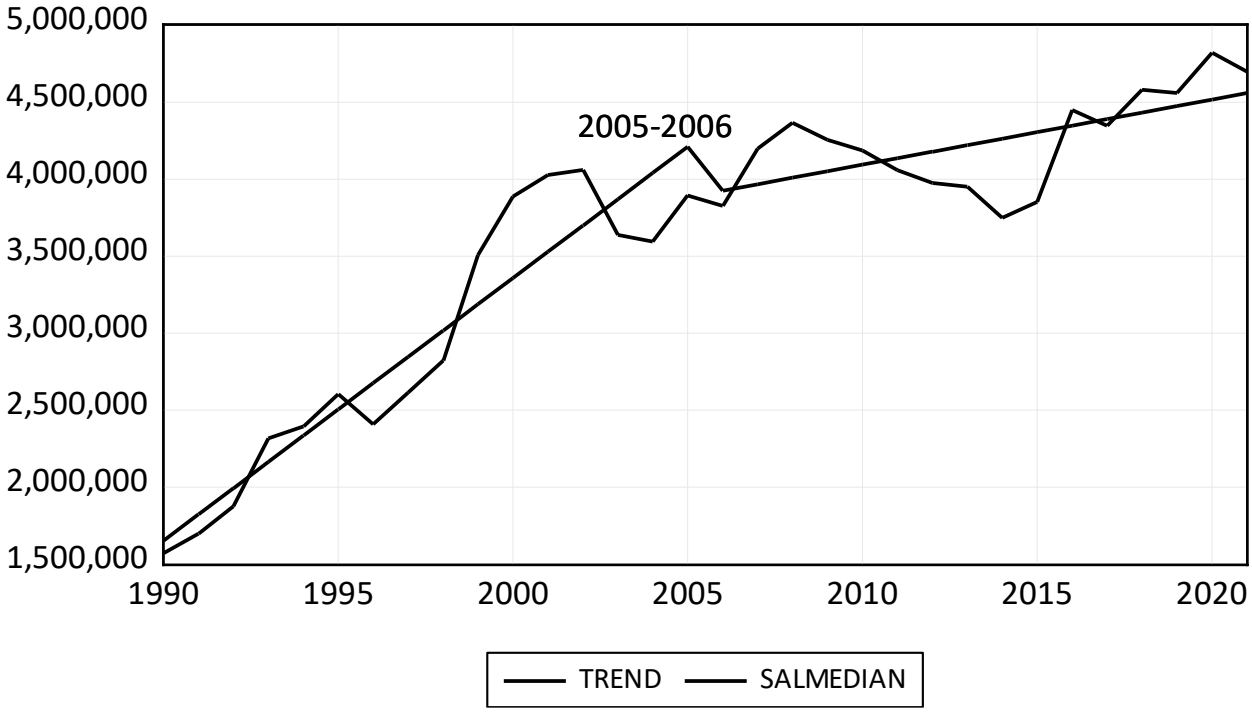

Figure 3. NBA Gini and Trend with Structural Breaks in 1997-98 and 2009-10.

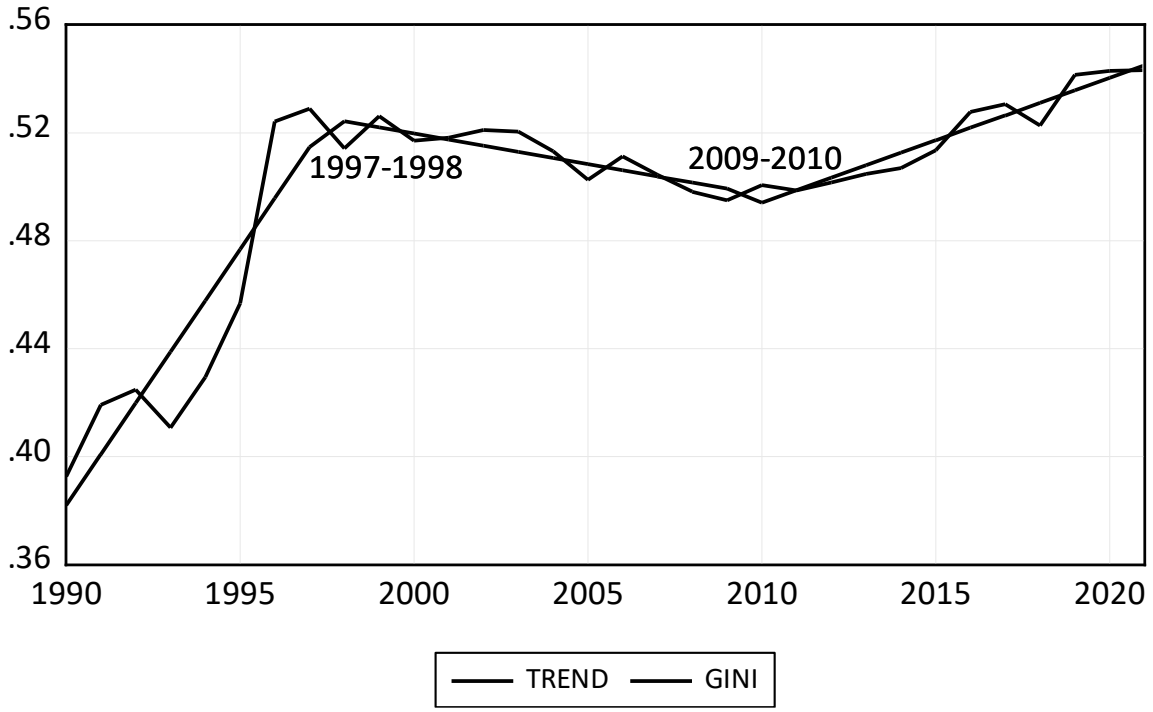

Figure 4. NBA, Real Revenue (Billions 2023$) and Trend with Structural Breaks in 2014-15 and 2018-19.

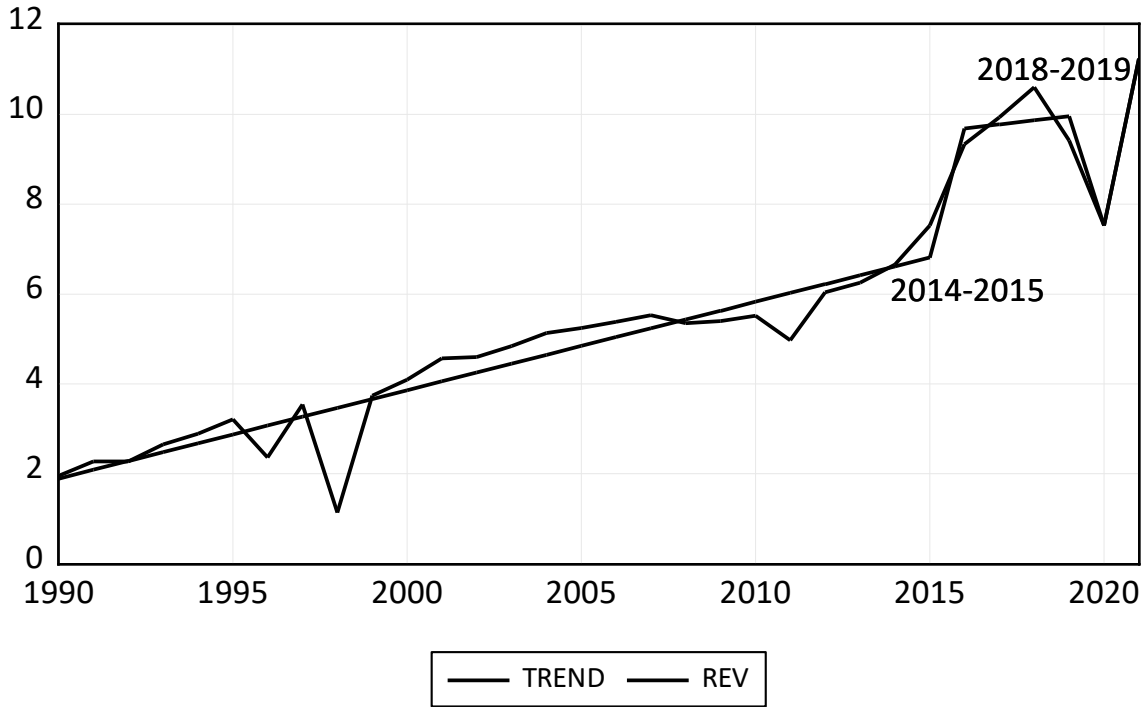

Table 3

Time Series	*Breaks Years*	*Historical Event*
MEAN	1997-98	*One year before the 1998-1999 lockout (six months)*
	2009-10	*Two years before the 2011-2012 lockout (five months)*
MEDIAN	2005-06	*On the 2005-2006 Collective Bargaining Agreement*
GINI	1997-98	*One year before the 1998-1999 lockout (six months)*
	2009-10	*Two years before the 2011-2012 lockout (five months)*
REVENUE	2014-15	*New media agreements that were almost triple the annual value of the previous agreements*
	2018-19	*COVID Shutdown on March 11, 2020*

Figure 5. Lorentz Curves. First Era: 1990-1991 to 1997-1998

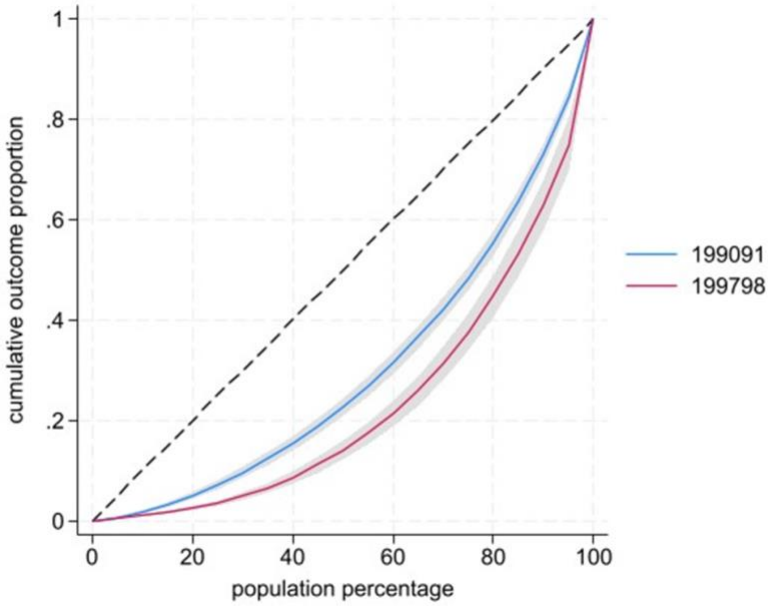

Table 4: Lorenz Curves Dominance. First Era: 1990-1991 to 1997-1998

salary	Coefficient	Std. err.	t	P>|t|	[95% conf. interval]	
0	0 (omitted)					
5	.0000504	.0006265	0.08	0.936	-.0011793	.0012801
10	-.0018983	.0011221	-1.69	0.091	-.0041006	.000304
15	-.0051656	.0017075	-3.03	0.003	-.0085168	-.0018144
20	-.0088757	.0022938	-3.87	0.000	-.0133776	-.0043738
25	-.0117088	.0033211	-3.53	0.000	-.018227	-.0051907
30	-.0125276	.0046517	-2.69	0.007	-.0216574	-.0033978
35	-.013526	.0060753	-2.23	0.026	-.0254498	-.0016021
40	-.0131809	.0078242	-1.68	0.092	-.0285374	.0021755
45	-.0114224	.0097015	-1.18	0.239	-.0304633	.0076185
50	-.0111298	.0114979	-0.97	0.333	-.0336965	.0114369
55	-.0118869	.0134618	-0.88	0.377	-.0383079	.0145342
60	-.0125561	.0156962	-0.80	0.424	-.0433626	.0182503
65	-.0142693	.0178556	-0.80	0.424	-.049314	.0207754
70	-.0169228	.0202592	-0.84	0.404	-.0566849	.0228393
75	-.0187875	.0222506	-0.84	0.399	-.062458	.0248831
80	-.0201934	.0241123	-0.84	0.403	-.0675179	.0271311
85	-.0305985	.0260339	-1.18	0.240	-.0816946	.0204975
90	-.0439046	.0273606	-1.60	0.109	-.0976045	.0097953
95	-.0613239	.0274164	-2.24	0.026	-.1151333	-.0075146
100	0 (omitted)					

Table 5: A Rising Tide: Salaries Era 1 (Free Agency)

Season	1990-91	Season	1997-1998		
Percentiles	Salaries	Percentiles	Salaries	Change	Percent
1%	$279,388	1%	$458,820	$206,432	74%
5%	$349,235	5%	$516,172	$166,973	48%
10%	$500,570	10%	$516,172	$15,602	3%
25%	$931,293	25%	$947,975	$16,682	2%
Median	$1,571,557	Median	$2,614,819	$1,043,262	66%
Mean	$2,015,422	Mean	$4,127,738	$2,112,316	105%
75%	$2,595,979	75%	$5,536,174	$2,940,195	113%
90%	$4,074,407	90%	$8,721,371	$4,646,964	114%
95%	$5,122,112	95%	$11,400,000	$6,277,888	123%
99%	$6,751,875	99%	$23,500,000	$16,748,125	248%
Revenues	$1.95B	Revenues	$3.54B	$1.59B	81.50%

Figure 6. Lorentz Curves. Second Era: 1997-1998 to 2009-2010

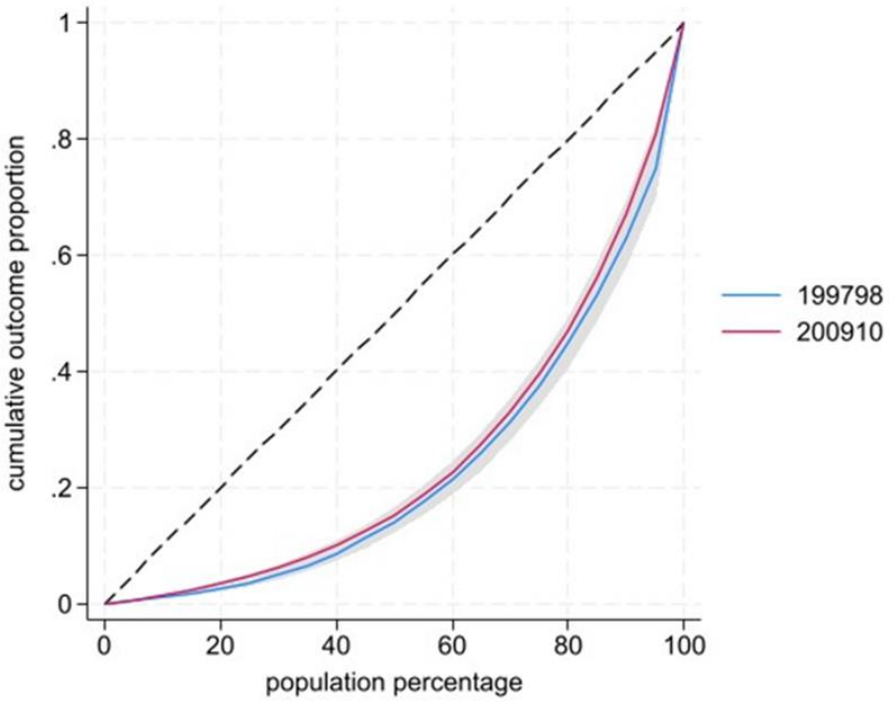

Table 6: Lorenz Curves Dominance. Second Era: 1997-1998 to 2009-2010

salary	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
0	0 (omitted)					
5	.0000504	.0006265	0.08	0.936	-.0011793	.0012801
10	-.0018983	.0011221	-1.69	0.091	-.0041006	.000304
15	-.0051656	.0017075	-3.03	0.003	-.0085168	-.0018144
20	-.0088757	.0022938	-3.87	0.000	-.0133776	-.0043738
25	-.0117088	.0033211	-3.53	0.000	-.018227	-.0051907
30	-.0125276	.0046517	-2.69	0.007	-.0216574	-.0033978
35	-.013526	.0060753	-2.23	0.026	-.0254498	-.0016021
40	-.0131809	.0078242	-1.68	0.092	-.0285374	.0021755
45	-.0114224	.0097015	-1.18	0.239	-.0304633	.0076185
50	-.0111298	.0114979	-0.97	0.333	-.0336965	.0114369
55	-.0118869	.0134618	-0.88	0.377	-.0383079	.0145342
60	-.0125561	.0156962	-0.80	0.424	-.0433626	.0182503
65	-.0142693	.0178556	-0.80	0.424	-.049314	.0207754
70	-.0169228	.0202592	-0.84	0.404	-.0566849	.0228393
75	-.0187875	.0222506	-0.84	0.399	-.062458	.0248831
80	-.0201934	.0241123	-0.84	0.403	-.0675179	.0271311
85	-.0305985	.0260339	-1.18	0.240	-.0816946	.0204975
90	-.0439046	.0273606	-1.60	0.109	-.0976045	.0097953
95	-.0613239	.0274164	-2.24	0.026	-.1151333	-.0075146
100	0 (omitted)					

Table 7: A Rising Tide: Salaries Era 1 (Median Voter Model)

Season	1997-98	Season	2009-2010		
Percentiles	Salaries	Percentiles	Salaries	Total	Percent
1%	$458,820	1%	$649,156	$190,336	42%
5%	$516,172	5%	$1,044,721	$528,549	102%
10%	$516,172	10%	$1,213,212	$697,040	135%
25%	$947,975	25%	$1,853,400	$905,425	96%
Median	$2,614,819	Median	$4,255,944	$1,641,125	63%
Mean	$4,127,738	Mean	$6,769,490	$2,641,752	64%
75%	$5,536,174	75%	$9,221,212	$3,685,038	67%
90%	$8,721,371	90%	$16,500,000	$7,778,629	89%
95%	$11,400,000	95%	$21,800,000	$10,400,000	91%
99%	$23,500,000	99%	$28,400,000	$4,900,000	21%
Revenues	**$3.54B**	**Revenues**	**$5.40B**	**$1.86B**	**53%**

Figure 7. Lorentz Curves. Third Era: 2009-2010 to 2021-2022

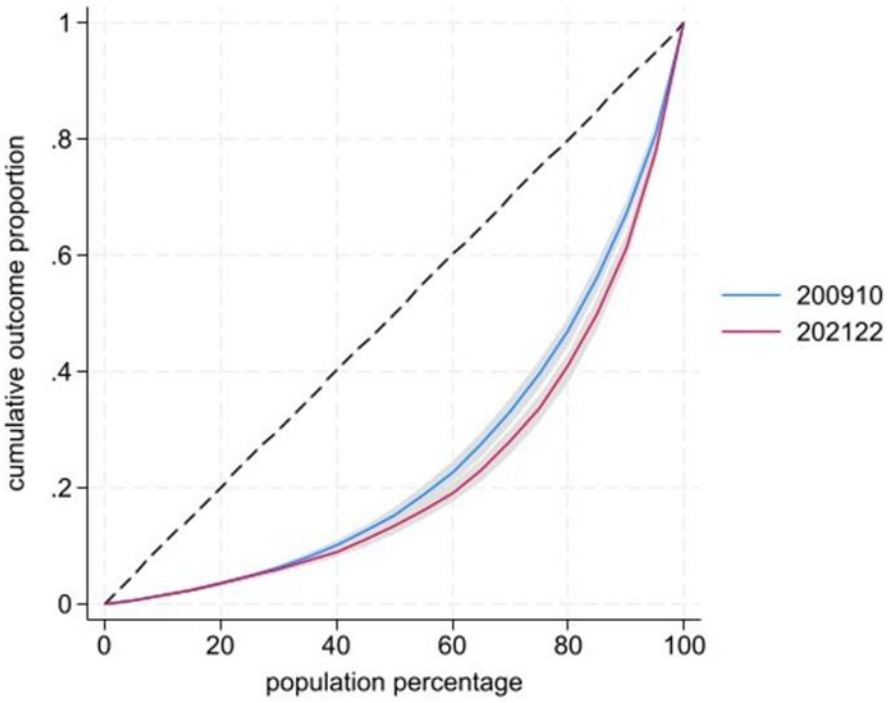

Table 8: Lorenz Curves Dominance. Third Era: 2009-2010 to 2021-22

salary	Coefficient	Std. err.	t	P>|t|	[95% conf. interval]	
0	0 (omitted)					
5	-.0004452	.0006601	-0.67	0.500	-.0017407	.0008503
10	-.0009756	.0012405	-0.79	0.432	-.0034103	.001459
15	-.0012386	.0019074	-0.65	0.516	-.0049819	.0025047
20	-.000784	.0025388	-0.31	0.758	-.0057666	.0041986
25	.0004487	.0033322	0.13	0.893	-.0060909	.0069883
30	.0019503	.0042255	0.46	0.645	-.0063424	.010243
35	.0051034	.0053126	0.96	0.337	-.0053227	.0155295
40	.0099899	.0062881	1.59	0.112	-.0023509	.0223306
45	.0144322	.0076165	1.89	0.058	-.0005154	.0293799
50	.0198967	.0091273	2.18	0.030	.001984	.0378095
55	.0269591	.0107672	2.50	0.012	.0058281	.0480901
60	.0359961	.0122347	2.94	0.003	.011985	.0600073
65	.0441929	.0142023	3.11	0.002	.0163204	.0720655
70	.0511308	.0159174	3.21	0.001	.0198922	.0823694
75	.059276	.0168972	3.51	0.000	.0261146	.0924374
80	.0610785	.0177187	3.45	0.001	.0263048	.0958521
85	.0629899	.0182654	3.45	0.001	.0271434	.0988365
90	.0598719	.0164157	3.65	0.000	.0276553	.0920884
95	.0312191	.0123055	2.54	0.011	.007069	.0553692
100	0 (omitted)					

Table 9: A Rising Tide: Salaries Era 3 (Hybrid Model)

Season Percentiles	2009-10 Salaries	Season Percentiles	2021-22 Salaries	Change	Percent
1%	$649,156	1%	$1,038,952	$389,796	60%
5%	$1,044,721	5%	$1,403,598	$358,877	34%
10%	$1,213,212	10%	$1,704,508	$491,296	40%
25%	$1,853,400	25%	$2,299,700	$446,300	24%
Median	$4,255,944	Median	$4,698,976	$443,032	10%
Mean	$6,769,490	Mean	$9,476,370	$2,706,880	40%
75%	$9,221,212	75%	$11,700,000	$2,478,788	27%
90%	$16,500,000	90%	$25,200,000	$8,700,000	53%
95%	$21,800,000	95%	$35,500,000	$13,700,000	63%
99%	$28,400,000	99%	$46,200,000	$17,800,000	63%
Revenues	$5.40B	Revenues	$11.24B	$5.84B	108%

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