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Parity in Professional Sports – How Salary Caps Affect Competitive Balance

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ABSTRACT

What keeps fans watching sports night after night, season after season? Competitive balance. Part of the fun for the average fan watching sports is not knowing what is going to happen or what team will win. If the best team won its respective championship every single year, sports would not be worth watching. Competitive balance is what keeps fans engaged even when the odds are stacked against a particular team. Now, the NHL, NFL, NBA, and MLB have utilized their own policies to increase competitive balance, and none is more popular than implementing a salary cap. This effectively acts as a price ceiling for teams to spend on their payrolls, ensuring that teams in small markets can compete with teams in big markets that have more resources, like New York or Los Angeles, for example. But, it is not a given that salary caps automatically improve competitive balance. This thesis develops on prior research to assess whether salary caps influence competitive balance in the NHL, NFL, NBA, and MLB by using Brad R. Humphreys' Competitive Balance Ratio as the primary method to measure parity in each league.

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INTRODUCTION

Professional sports in the United States are an integral part of the nation's culture. Fans across the country gather to watch their favorite teams play with the hopes of competing for a championship every season. Many franchises across the four major professional sports leagues in the United States have won multiple championships and have dominated their respective leagues for long stretches of time. On the other hand, some franchises have never even had much success in their respective leagues, let alone won a championship. Still, this mix keeps fans engaged because nobody knows for sure who will win. This is what makes sports worth watching and is why competitive balance is an integral part of each league's success.

Competitive balance is a measure of parity, ensuring that one team does not have an unfair advantage over the other. This gives each team a fighting chance of finding success in a season. Essentially, this is what makes sports exciting and worth watching. If the outcome of a game or season was easily predictable, demand for the product would decline. This is why professional sports leagues aim to increase competitive balance. The goal is to keep fans engaged.

League commissioners have implemented many rules and policies to increase competition within their leagues, such as revenue sharing, free agency restrictions, and reverse draft orders, but salary caps have generally been the favored approach to improve competitive balance (Badenhausen, 2015). A salary cap is the maximum amount of money that a team can spend on its players. This prevents the richest and most valuable teams that are in "big markets," such as New York City or Los Angeles, from out paying all the other teams for high-quality players just because they have the capital to do so.

Three of the four major professional sports leagues have employed a salary cap seeking to increase competitive balance. The National Basketball Association (NBA) was the first to

introduce a salary cap in 1984, followed by the National Football League (NFL) in 1994 (Staudohar, 1998). The National Hockey League (NHL) introduced a salary cap after the 2004-05 NHL lockout, which resulted in the cancellation of that season in the NHL (Rovell, 2018). Of these three leagues, the NHL is the only league that uses a "hard cap," which essentially means that there are no exceptions to spending over the limit, while the NBA and NFL implemented their own league-specific exceptions to exceeding the salary cap. Major League Baseball (MLB) remains the only league that does not have a salary cap but instead has a luxury tax.

It has been long argued that salary caps increase competitive balance in sports and that the MLB should finally implement a salary cap. This argument was especially prevalent among sports fans when the New York Yankees won four World Series titles in five seasons between 1996 and 2000 while having the highest payroll in baseball during each of those seasons. However, recent history suggests that salary caps may not improve competitive balance in sports leagues.

In the NHL, the Tampa Bay Lightning won two consecutive Stanley Cups in 2020 and 2021, while also making their third consecutive Stanley Cup Finals appearance in 2022. Just a few years before that, the Pittsburgh Penguins repeated as Stanley Cup champions in 2016 and 2017. Competitive balance seems to be worse in the NBA, as the Golden State Warriors made five consecutive NBA Finals appearances from 2015 to 2019, winning the championship in three of them and adding a fourth in eight years in 2022. The first four appearances for the Warriors all came against the Cleveland Cavaliers. The New England Patriots were the NFL's dominant franchise between 2015 and 2019, winning three Super Bowls in four appearances in that span.

On the other hand, the MLB, the only professional sports league without a salary cap, has not seen the same amount of dominance in terms of championships recently. There has not been a

repeat World Series winner since the New York Yankees won three consecutive titles between 1998 and 2000.

As three of the four major professional sports leagues have implemented a salary cap, and one has a luxury tax system, it raises the argument over whether it is an effective way to increase competition. But, there are numerous ways to measure competitive balance. Some works of literature use the standard deviation of winning percentages or the Herfindahl–Hirschman Index. However, Humphreys (2002) designed the Competitive Balance Ratio and submits that it is a useful metric in measuring competition, as it captures season-to-season changes in standings and is more helpful in comparing across different periods.

Using the Competitive Balance Ratio as the primary method for measuring competition in the NHL, NFL, NBA, and MLB, this research explores whether salary caps increase competitive balance. My hypothesis suggests that leagues with stringent salary cap policies, like the NHL and NFL, will experience an increase in competitive balance. Conversely, leagues allowing teams to exceed set thresholds through generous policies, such as the NBA and MLB, will not see significant improvements in competitive balance after introducing a salary cap or luxury tax.

ANALYSIS OF SALARY CAP STRUCTURES IN MAJOR SPORTS

National Hockey League

The NHL has the most stringent salary cap of the three professional sports leagues. The cap was implemented in the wake of the 2004-05 NHL lockout. Once the NHL's Collective Bargaining Agreement (CBA) expired after the 2003-04 season, the NHL Players Association (NHLPA) opposed the league's idea of implementing a salary cap. After the 2004-05 season was canceled due to the lockout, the two sides eventually agreed to a hard salary cap based on a percentage of league revenues (Staudohar, 2005). The first NHL salary cap was then set at $39 million, becoming the most substantial change in the NHL's competitive balance policies (Eichel, 2008).

What makes the NHL salary cap so strict is the fact that teams cannot get rid of guaranteed player contracts. For example, NFL teams may get out of a player's guaranteed contract by cutting them. NHL teams must buy a player's contract out, as the player's cap hit is spread out over twice the remaining years on the contract (Brehm, 2023). The only way a player's cap hit does not count toward a team's total salary cap figure is if that player is placed on long-term injured reserve.

The NHL's Collective Bargaining Agreement expired again on September 15, 2012, resulting in the second NHL lockout in eight years. This lockout only lasted just under four months, as teams agreed to new revenue sharing terms and to limit the length of an individual player's contract to eight years. The current salary cap for the NHL is set at $83.5 million, after three years of the cap figure remaining flat due to a decline in revenue amid the COVID-19 pandemic (Wyshynski, 2022).

Major League Baseball

The MLB is the only North American professional sports league that does not use a salary cap. It uses a luxury tax called the "Competitive Balance Tax" instead. This was introduced in 1997 after the 1994 MLB season was cut short due to the 1994 Major League Baseball Strike, which resulted in the cancelation of the 1994 World Series (Staudohar, 1998). The resolution of the strike included that teams with the top five payrolls each year would pay a 34 percent fine, or "tax," on each dollar spent over the average of the fifth and sixth-highest team payrolls (Grow, 2015). This system was in place until the signing of the 2002 Collective Bargaining Agreement.

The 2002 CBA instead implemented a fixed figure that a team was not able to exceed without being taxed, which is a system that is still in place today. This was a major shift in the league's competitive balance policy, as the MLB implemented a progressive penalty scale to charge a harsher fine for teams that consistently broke the tax threshold, a system that is still in place today (Grow, 2015). If a team exceeds the threshold, it will be taxed at an increasing tax rate based on how many consecutive years it has done so. First-time offenders are not charged as high as second-time or three-time violators. Now, the luxury tax threshold for each team will be set at $237 million for the 2024 season. The first-year tax is 20 percent on all overages, the second-year is 30 percent, and 50 percent on all overages after that. Once all the taxes are paid, the MLB then redistributes it to other teams.

National Football League

The National Football League and National Football League Players Association (NFLPA) agreed to implement a salary cap that first took effect for the 1994 season. Starting at $34.06

million in 1994, the ceiling rose to $123 million for the 2009 season until the 2010 season was uncapped, which was intended to lure both sides to agree to a new collective bargaining agreement (Robinson, 2023). Although there was no salary cap in place, most teams spent as if the cap was still there.

The longest lockout in NFL history occurred after the 2010 season, which lasted four months. A new collective bargaining agreement, including increased player safety measures, player benefits, and minimum salaries, was signed in August 2011 (Rische, 2011). The current NFL salary cap now sits at $224.8 for the 2023 season after a new collective bargaining agreement was signed on February 20, 2020.

Unlike the NHL, players on Injured Reserve or the Physically Unable to Perform list count against the team's salary cap. The only players who do not are the ones on the NFL's exempt lists, which teams can only use in unusual circumstances. If a player is traded or released before the expiration of his contract, the team must still pay the guaranteed money and bonuses that were included in the contract, which all count toward the salary cap.

One of the most generous salary cap policies that is included in the collective bargaining agreement is the ability for teams to roll over any unused cap space from one season to the next, which would increase their cap room for the following season. However, the league also has a salary floor. Each team must spend at least 89% of the salary cap over four years, and the league as a whole must spend 95% of the cap (Robinson, 2023).

National Basketball Association

Since the league first implemented a salary cap of $3.6 million starting with the 1984-85 season, the ceiling has risen to roughly $136 million for the 2023-24 NBA season (Raje, 2023). The NBA has a much more complicated and generous salary cap system compared to the NFL and NHL. The league has a "soft cap" because it includes many rules that allow teams to go over the ceiling to pay players, which include the mid-level exception, bi-annual exception, bird rights, rookie scale exemption, and more (Quinn, 2022). The mid-level exception allows teams to sign free agents to contracts for up to four years even if they are above the cap. Teams can only use this exception once a season and cannot use it in back-to-back seasons. The bi-annual exception is like the mid-level exception, but it is used to sign players for only two years and a smaller amount. Bird rights allow teams to exceed the salary cap to resign their players who have played for a team for three consecutive seasons. The rookie scale exception allows teams to exceed the salary cap to sign their drafted rookies to structure, predictable contracts. This exception is supposed to improve competitive balance by preventing teams from spending excessive amounts on un-proven rookies. But, similar to the MLB, teams that exceed the cap threshold are subject to luxury tax penalties. The league redistributes these funds to teams that remain under the threshold.

The biggest change to the league's salary cap came at the signing of the 2011 NBA Collective Bargaining Agreement. Under the 2005 CBA, the cap was set as 57 percent of "basketball-related income." This figure decreased to 51.2 percent upon the signing of the 2011 CBA following the 2011 NBA lockout, which resulted in the cancellation of half the 2011-12 NBA season. The 2011 agreement also stipulated that teams must spend at least 85 percent of the cap in the 2011-12 and 2012-13 seasons, and at least 90 percent in the later seasons, a rise from 75 percent from the 2005 CBA (Coon, 2011).

In addition, the luxury tax threshold was also changed under the 2011 CBA. Before, teams had just paid $1 for every $1 their salary was over the luxury tax threshold, but an incremental tax system was implemented starting in the 2012-13 season (Coon, 2011). This change put an extra penalty on repeat offenders and teams that were over the threshold by a higher amount.

LITERATURE REVIEW

There are numerous ways to measure competitive balance in sports since there is not one uniform method. Measuring competitive balance can be difficult, as many people have different definitions of competitive balance and parity. Parity could relate to the dispersion of championships won by each team, or it could also have a greater emphasis on regular season performance by focusing on the dispersion of regular season winning percentages. Even though there have been many works of literature that try to analyze how different variables affect competitive balance in professional sports, there is no uniform method for measuring competitive balance.

Many previous works of literature, such as Totty and Owens (2011), use standard deviations of winning percentages for each team of the four sports leagues each year as a measure of competitive balance. This is a simple method of measurement, and it is relatively easy to compute. The limitation of this measure is that it is not consistent across time due to changes in the number of teams in each league and season length.

Another popular measure of competitive balance is the Herfindahl–Hirschman Index (HHI), which one could use to measure the concentration of championships in each league. This measure is also used in many works of literature, such as Scully (1989) and Depken (1999). HHI and the standard deviation of winning percentages both do not capture changes to the standings of teams within each league over time (Humphreys 2002).

Humphreys designed an alternative measure of competitive balance, the Competitive Balance Ratio (CBR). This measure is a ratio of the average standard deviation of each team's win-loss percentage across seasons and the average within-season variation in win-loss percentage. It "scales the average time variation in win-loss percentage for teams in the league by the average

variation in win-loss percentages across seasons," making it easier to compare across different periods of time (Humphreys 2002). For example, each team played 80 games in the NHL regular season from 1974 to 1992. After two seasons of each team playing 84 regular season games between 1992 to 1994, the NHL schedule shrunk from 84 to 82 games starting in 1995 and has continued to the present. This would make it complicated to compare the standard deviation of winning percentages in the league in 2016 and 1994. Humphreys applied the CBR to predict variation in MLB attendance, but it can be applied to other leagues on a greater scale.

Totty and Owens (2011) performed linear regressions using standard deviations of winning percentages for each team of the four sports leagues each year and the deviation of the Herfindahl–Hirschman Index (HHI) from an ideal distribution of wins. Using those two measures for competitive balance, Totty and Owens found no evidence to suggest that salary caps have improved competitive balance in professional sports.

Quirk and Fort (1997) also use the dispersion of winning percentages within sports leagues, for example. Humphreys (2002) points out several flaws in these measures, stating that HHI and standard deviation of winning percentages do not capture changes to standings of teams within each league over time.

When analyzing competitive balance, the majority of prior research has used standard deviations of winning percentages and HHIs of concentration of championships as measures of competitive balance. However, I submit that CBR is a better measure to use because it allows for the comparison across different periods of time. Humphreys used the CBR to analyze competitive balance only in the MLB during the 20th century. My study contributes beyond the prior literature by applying Humphreys' CBR measure on a greater scale, across all four major North American professional sports leagues, and using it to contextualize the results of different leagues introducing

a salary cap and implementing other substantial changes to their respective competitive balance

policies.

HYPOTHESIS DEVELOPMENT

Implementing a salary cap is an effective method for a league to keep competition fair between big and small markets. If leagues had no competitive balance measures, the richest teams in each league could spend all the money they want to acquire all-star caliber players and significantly skew competitive balance in each league no matter how it is measured. My research hypothesis is that implementing a salary cap will increase competitive balance in leagues that have a hard cap with stricter policies, such as the NHL and NFL.

I also believe that allowing teams to spend over the salary cap with generous policies, such as the NBA "soft cap" rules, defeats the purpose of implementing a salary cap in the first place. Therefore, I do not expect there to be a material difference in competitive balance after implementing a salary cap or luxury tax in the NBA and MLB. If a league is to implement a salary cap, there should be a strict set of rules attached to it, and I expect the analysis to show that the stricter the rules, the greater effect a salary cap will have on competitive balance.

DESIGN

To start testing my hypothesis, I collected data that is comprised of every team's season record in each of the four major professional sports leagues dating as far back as the 1960s, along with a small team success dataset that consisted of each league's championship winner by year. The data was collected from four main sources: Hockey Reference, Pro Football Reference, Baseball Reference, and Basketball Reference. The data acquired from the last three sources included each team's winning percentage, which is the proportion of games each team won in a given season, but the NHL data did not include this measure. Points percentage is a better indicator of team success in the NHL rather than winning percentage because the league standings are determined by what team has the most points, as opposed to simply ranking teams higher if it has more wins. Teams in the NHL receive two points for a win, one point if it loses in overtime, and no points for a regulation loss. Considering this, I computed points percentage using the commonly used equation below (Fandom, Inc):

$$point\ percentage = \frac{points}{games\ played * 2}$$

To increase the quality of my results, I used data consisting of different time periods depending on the sport, considering the respective mergers and changes to each league throughout the 20th century.

Data Summary

League	Start Date	End Date	Explanation
NHL	1967	2020	NHL Expansion
NFL	1971	2020	NFL-AFL Merger
NBA	1976	2020	ABA-NBA Merger
MLB	1961	2020	MLB Expansion

After gathering the data, my analysis began with computing the three following measures of competitive balance: standard deviation of winning percentages for each league, Herfindahl-Hirschman Indexes (HHIs) of the concentration of championships, and the Competitive Balance Ratio (CBR). Each of the three measures were measured over five-year intervals, ending with the most recent season for each league. The standard deviation of winning percentages for each league was defined as the following:

$$\sigma_L = \sqrt{\frac{\sum_{i=1}^{N} \sum_{t=1}^{T} (WPCT_{i,t} - 0.500)^2}{NT}}$$

$WPCT_{i,t}$ is the winning percentage of team i in season t. N is the number of teams in a given time period and T is the number of seasons.

The second measure of competitive balance I computed was the HHI of concentration of championships in each league.

$$HHI = 10,000 \left[\left(\frac{S_1}{S_T}\right)^2 + \left(\frac{S_2}{S_T}\right)^2 + \left(\frac{S_3}{S_T}\right)^2 + \cdots + \left(\frac{S_n}{S_T}\right)^2 \right]$$

S_i is the number of championships won by team 1, and S_T is the number of championships awarded in a given period. In the case of this analysis, S_T is equal to five championships, since five-year intervals are being used, with an exception for the 2004-05 NHL lockout that canceled the entire 2004-05 season, and the 1994-95 MLB Strike that resulted in the cancelation of the entire 1994 postseason and 1994 World Series. The lower the HHI measure, the more competitive balance there is.

Finally, I calculated Humphrey's Competitive Balance Ratio measure for each league. The CBR is the ratio of the average standard deviation of each team's win-loss percentage across seasons and the average within-season variation in win-loss percentage (Humphreys):

$$CBR = \frac{\bar{\sigma}_T}{\bar{\sigma}_N}$$

The numerator in the equation is the average standard deviation of each team (team i's) winning percentage across T seasons. Each team in the league has its own vector of $\sigma_{T,i}$. A smaller value of $\sigma_{T,i}$ suggests less variation in the winning percentage during the seasons being analyzed. For example, when analyzing the NHL, each team has its own vector of $\sigma_{T,i}$ in the 1970–1975 interval. Each of those teams' vectors are then averaged to output a $\bar{\sigma}_T$ vector, which is the numerator in the CBR equation.

$$\sigma_{T,i} = \sqrt{\frac{\sum_t \left(WPCT_{i,t} - \overline{WPCT_i}\right)^2}{T}}$$

$$\bar{\sigma}_T = \frac{\sum_i \sigma_{T,i}}{N}$$

The standard deviation of win-loss percentage in each season across all teams in the league is the denominator of the equation, defined as $\sigma_{N,t}$, which is identical to σ_L. There is one $\sigma_{N,t}$ vector for each season. This measure is then averaged across five-season intervals, for the purposes of this analysis, to arrive at $\bar{\sigma}_N$.

$$\sigma_{N,t} = \sqrt{\frac{\sum_t \left(WPCT_{i,t} - 0.500\right)^2}{N}}$$

$$\bar{\sigma}_N = \frac{\sum_t \sigma_{N,t}}{T}$$

RESULTS

National Hockey League

Following the implementation of a hard salary cap in the wake of the 2004-05 lockout, the National Hockey League saw a sustained increase in competitive balance. On the surface, in a given five-year period, the average number of teams that won a championship was 3.0 between 1967 and 2005. This is interpreted as, on average, three different teams won a championship in a given five-year period, meaning that two of those three teams won a championship twice. In the five-year periods from 2005 and onwards, the average amount of teams that won a championship increased to 3.75, a 25 percent increase. This is reflected in the HHI measure, as it decreased after the hard cap was employed.

Figure 1 - NHL HHI
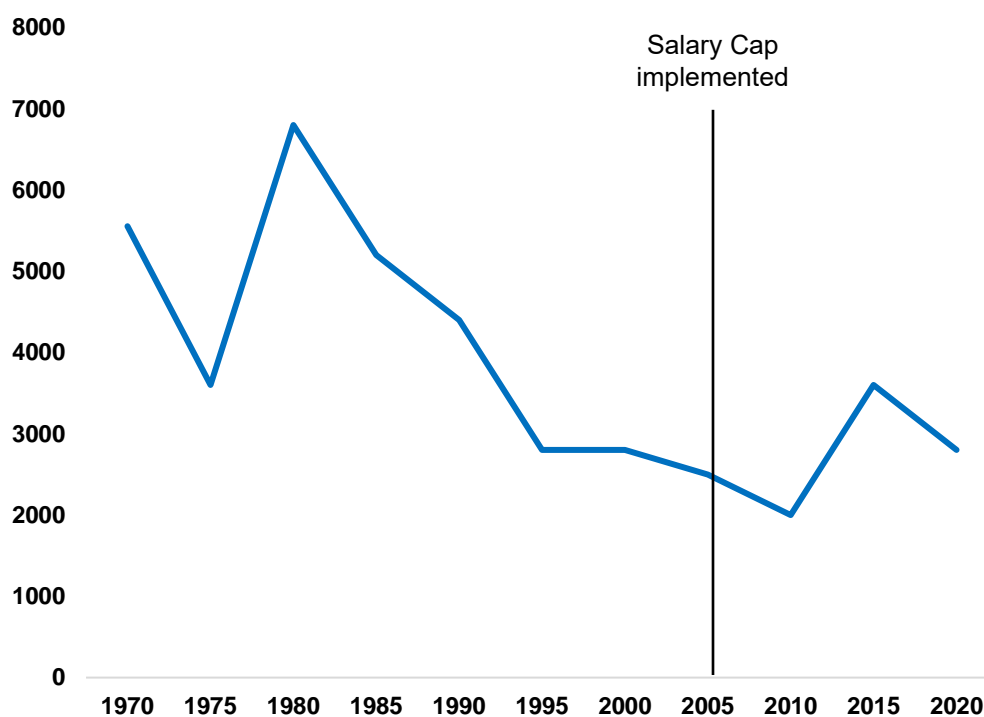
HHI in concentration of championships was already on the decline, meaning competitive balance was increasing, since 1980 before the NHL implemented a salary cap. But, as mentioned earlier, winning championships does not tell the entire story. Using Humphreys' Competitive Balance Ratio, the competitive balance in the NHL also started to increase after 1980. This could be attributed to the NHL expanding from six teams to 21 between 1967 and 1979. With more teams coming into the league, the less one particular team's performance affects the overall standard deviation of team winning percentages.

The Competitive Balance Ratio captured a sustained increase in competitive balance after the NHL implemented a salary cap for the 2005-06 season. The CBR also showed an improvement in competitive balance after 1980, but the main focus is the sustained increase seen after 2005.

Figure 2 - NHL Competitive Balance Ratio
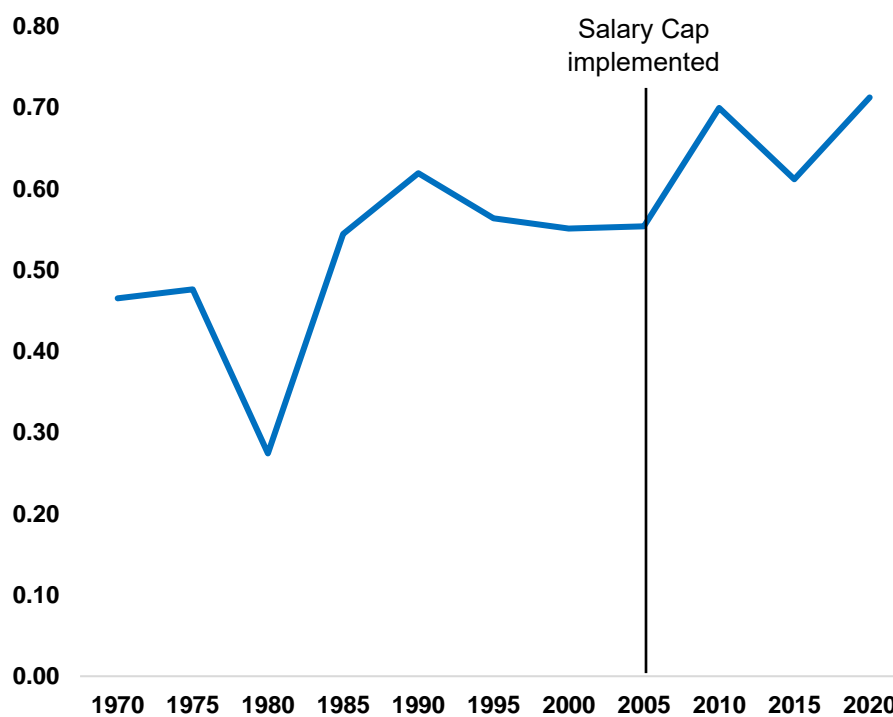
The average CBR between 1985 and 2005 increased by approximately 14.59 percent to 0.67 from 2005 to 2020. Table 1 shows the three measures of competitive balance side-by-side. σ_L and the CBRs explain the same information, as the standard deviation of winning percentages has fallen as CBR increased, meaning competitive balance increases, as well. Lee (2021) found similar results when analyzing NHL competitive balance after unrestricted free agency and a hard salary cap were implemented by using a lagged winning percentage measure.

These results echo public and league sentiment over recent years. NHL Commissioner Gary Bettman, league personnel, and fans alike have all boasted about the league's parity. Since 2005, only two teams have repeated as Stanley Cup Champions, the Pittsburgh Penguins in 2016 & 2017 and the Tampa Bay Lightning in 2020 & 2021.

National Football League

Similar to the NHL, the Competitive Ratio National Football League captured a sustained increase in competitive balance after the NFL enacted a salary cap starting in the 1994 season. HHI of concentration of championships and standard deviation of winning percentage do not tell the same story, though, which shows the benefit of using the CBR. For example, Table 3 shows σ_L only decreasing from 0.19 to 0.18 between 1995 and 2000, the first full period after a salary cap was implemented, while the CBR increased by 12.20 percent from 0.67 to 0.75, and it sustained that increase. The average CBR between 1970 and 1995 was 0.68, increasing to 0.73 from 1995 to 2020.

Figure 3 - NFL Competitive Balance Ratio
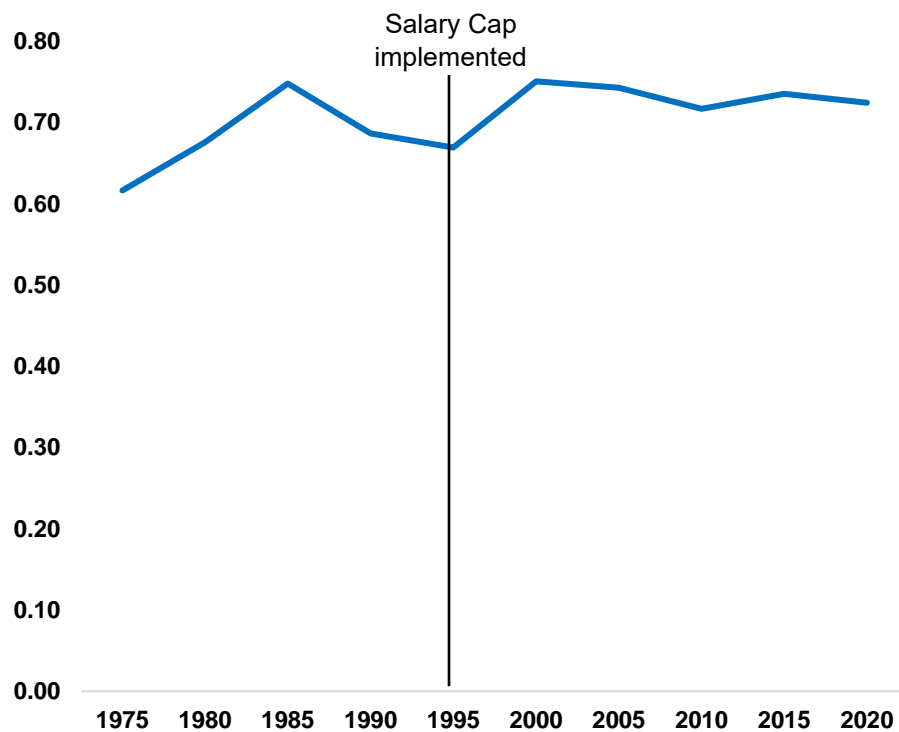
Even though competitive balance, in terms of winning percentage, increased after 1994, there still has been a high concentration of championships in these five-year intervals since 2005. This is a product of the New England Patriots' dominance in the NFL after 2000, winning three Super Bowls in two different five-year periods. Between 2000 and 2005, the Patriots won Super Bowl XXXVI (2001), Super Bowl XXXVIII (2003), and Super Bowl XXXIX (2004). Then, the team won Super Bowl XLIX (2014), Super Bowl LI (2016), and Super Bowl LIII (2018), recording another three championships in a five-year interval.

Figure 4 - NFL HHI
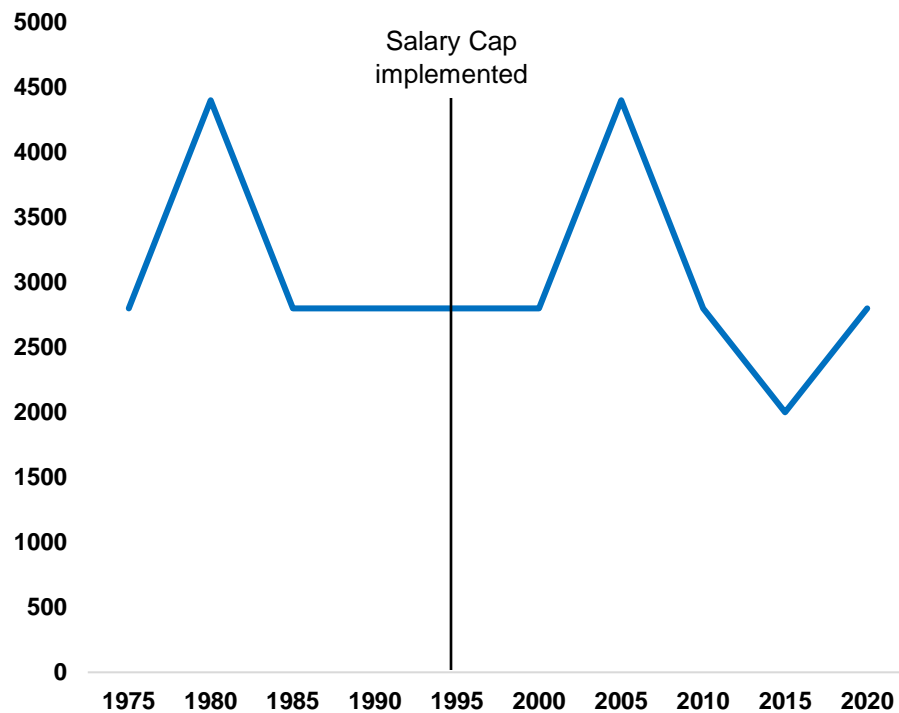
Even though the HHI of concentration of championships showed less competitive balance in the period 2015-2020, the CBR clocked in at 0.72 for that same period, slightly less than the average of 0.73 after 1995, but still showing a consistently competitive regular season. In addition, 29 different teams made the playoffs, and 23 different teams won their respective divisions throughout those five years. This turnover in the standings lines up with a relatively high CBR of 0.73 for that period.

National Basketball Association

The National Basketball Association did not see much of a sustained increase in competitive balance immediately after the soft cap in 1984. In fact, the league's Competitive Balance Ratio declined until 1990, when the ratio hit its lowest point at 0.47. It then gradually

began to rise, reached its peak at 0.64 in 2010, and has stayed steady there ever since. Since the sample size of only nine years before a salary cap was implemented in the league is relatively small (1976-1984), it is difficult to compare the before-and-after effects and conclude whether or not it led to an increase in competitive balance. There also has not been a noticeable effect on competitive balance since the 2013 CBA was signed.

Figure 5 - NBA Competitive Balance Ratio
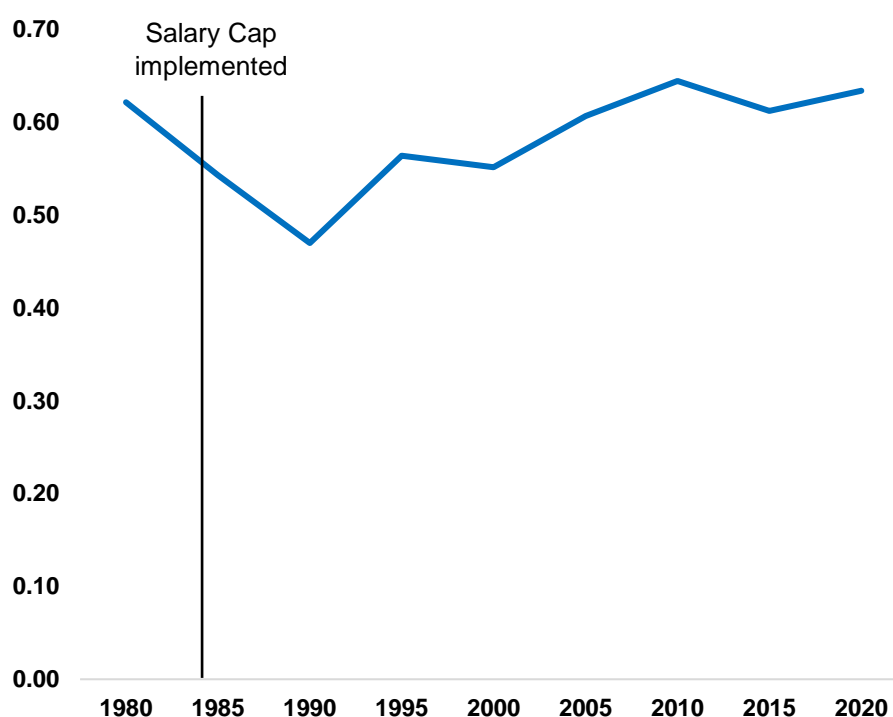
The steep drop-off from 1980 to 1990 can be due to the dominance of teams like the Boston Celtics and Los Angeles Lakers. In that ten-year span, the two teams won a total of eight NBA championships: three for the Celtics and five for the Lakers. The Celtics won the league's Atlantic Division six times, and the Lakers won the Pacific Division seven times. In total, only 16 different teams came out as division winners over those ten years, showing little turnover in the standings.

The rise in competitive balance in the league came when the Chicago Bulls dynasty, which won six championships in the 1990s, broke up, and there was no longer one single dominant force in the league. While the Los Angeles Lakers won four championships between 2000 and 2009, the regular season became more of a competitive affair, with 19 different teams winning their respective divisions in that period, followed by 20 different teams in the 2010s.

However, because teams can exceed the soft cap with various exceptions, the introduction of a salary cap in the NBA has not had a material effect on competitive balance. Championships in the NBA have still been highly concentrated. The ability for teams to manipulate the soft cap has allowed for the construction of "super teams."

Recently, the Miami Heat were able to carry LeBron James, Chris Bosh, and Dwayne Wade for four seasons. The Heat won two championships and represented the Eastern Conference in all four of those years. The Golden State Warriors then went above the salary cap to sign Kevin Durant, joining the already dominant team that included Steph Curry, Draymond Green, and Klay Thompson. Durant spent three seasons with the Warriors, winning two championships and three Western Conference titles. The Warriors and Cleveland Cavaliers met in the NBA Finals for four consecutive years between 2015 and 2018.

Major League Baseball

Major League Baseball is the only major professional sports league that has not implemented a salary cap. It implemented the Competitive Balance Tax in 1997. Since then, the Competitive Balance Ratio has shown a slight increase in competitive balance in the league, but not by much, as there was already a relatively high level of competitive balance in the league

before the CBT was implemented. The average CBR between 1975 and 1994 was 0.68, which increased only to an average of 0.69 between 1995 and 2020.

In addition to looking at only league-wide results, I also broke down the MLB results into the National League and American League to compare the competitive balance between the two leagues and with the MLB as a whole, since the two leagues were only allowed to face each other in the regular season starting in 1997. The CBR generally moved in the same direction for all three vectors, as the biggest deviation came when the ratio decreased in the American League between 2000 and 2010. Between 2005 and 2009, the CBR in the American League was 0.54, 22 points lower than the National League CBR of 0.76 during that period. Table 7 also shows the NL's σ_L vector is approximately 24 percent lower than that of the AL for that period.

Figure 6 - MLB, NL, AL Competitive Balance Ratios
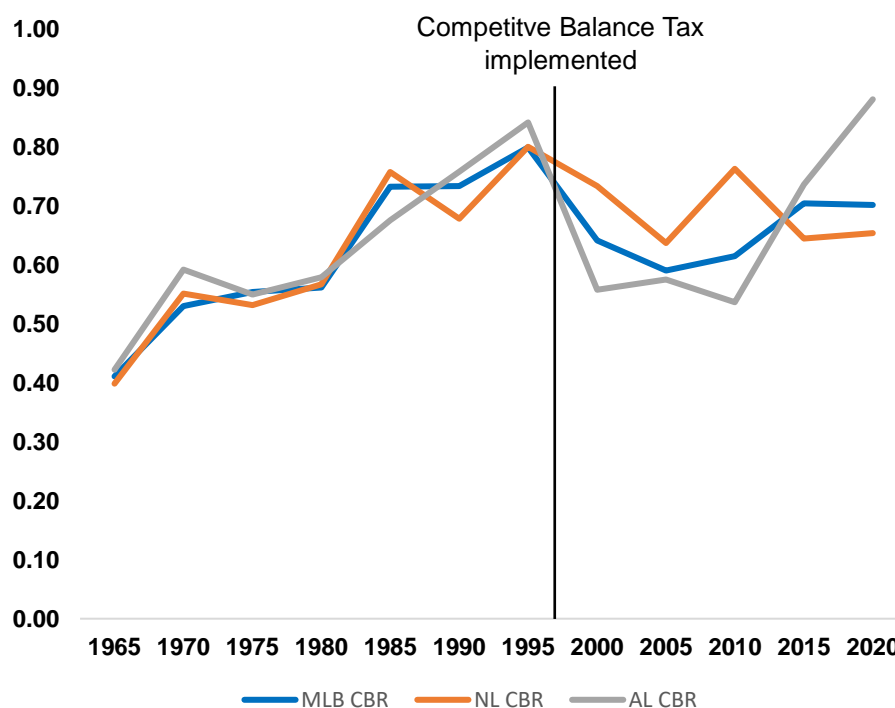
This large disparity could be due to the regular season dominance of the New York Yankees and the then-named Cleveland Indians in their respective American League divisions, which meant there was little turnover in the standings year-over-year. The Indians won the AL Central Division five years in a row, from 1995 to 1999, while the Yankees prevailed in the AL East eight out of ten seasons between 1995 and 2004. Four of the top five taxed teams between 1997 and 1999 for exceeding the Competitive Balance Tax threshold were from the American League, including the Yankees and Indians (The Baseball Cube). The Yankees remained on top of the league in payroll every year between 1999 and 2013.

The graph also shows a bit of a lag effect from after the CBT was established and the tax system was altered in 2002. It took until after 2009 for competitive balance to increase again. The lag makes sense, as it takes time to transition to a new policy if there is not a hard rule, like when the NHL salary cap was put into effect. Teams were not required to change their payrolls if they paid the tax, and it took a while for talent to be redistributed in the league.

Even though the MLB regular season has been competitive, the concentration of championships has fluctuated over the years.

Figure 7 - MLB HHI
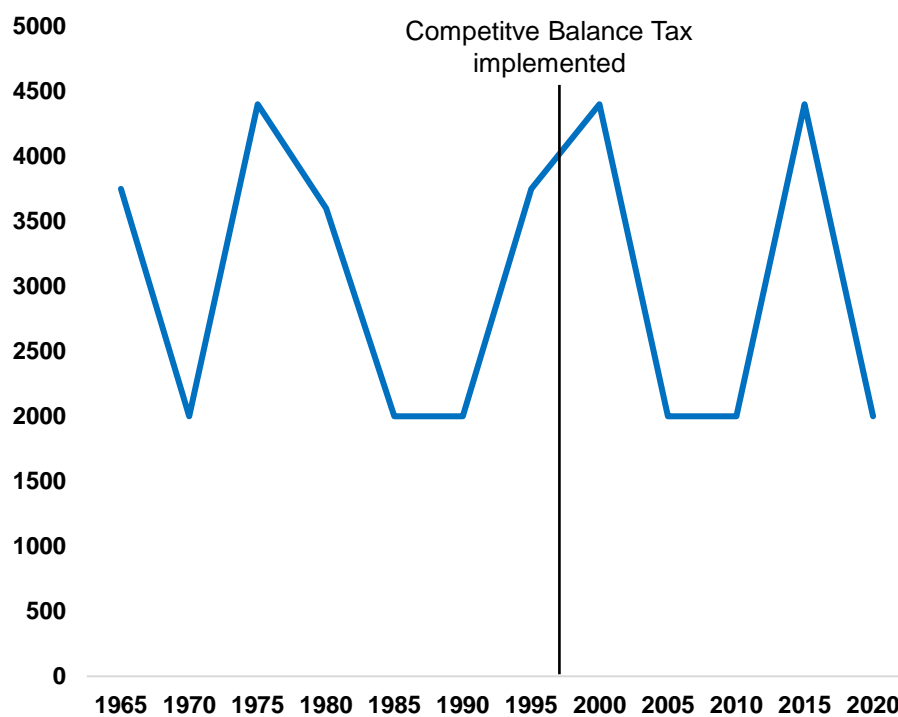
The 1990s had only six World Series winners, and the 2010s had only seven, compared to ten World Series winners in ten seasons between 2000 and 2009.

CONCLUSION

The purpose of this research is to determine whether salary caps have had a material effect on competitive balance in professional sports. Most studies used the Herfindahl–Hirschman Index or standard deviation of winning percentages to examine competitive balance, but none have used Humphreys' CBR measure. This thesis contributes to prior sports economic literature by using Humphreys' Competitive Balance Ratio and applying it across all four major sports leagues over a longer period, as Humphreys' study only used MLB data in the 20th century.

My analysis concluded that the NHL saw a sustained increase in competitive balance immediately after introducing a salary cap in 2005. There was no lag effect, as the ratio rose and stayed above 0.60 since the first season the cap was implemented. The CBR also captured a sustained increase in competitive balance for the NFL, rising by 12.20 percent from 0.67 to 0.75 after the league introduced a hard cap in 1994. There was also no lag effect for this league. The NBA's soft cap did not appear to have much of a material effect on competitive balance in the league, as the ratio has generally stayed between 0.57 and 0.61 following the league's introduction of a salary cap. Finally, Major League Baseball had a slight increase in competitive balance after implementing the Competitive Balance Tax in 1997, but the effect was not material enough to conclude that the tax system significantly improved competition. There was already a high level of competition before the tax system.

Overall, this research has concluded that salary caps had the greatest effect on competitive balance in the National Hockey League and National Football League, where each league has a hard cap. Major League Baseball's Competitive Balance Tax did not have a material

effect on competitive balance in the league, and neither did the National Basketball Association's soft cap. As this study is the first to use Humphreys' nuanced method of measuring competitive balance, future research can draw on his CBR measure to predict how competitive balance affects various factors in professional sports such as revenue, attendance, ticket sales, and more.

APPENDIX

Table 1 - NHL Analysis

	1967 1970	1970 1975	1975 1980	1980 1985	1985 1990	1990 1995	1995 2000	2000 2005	2005 2010	2010 2015	2015 2020
σ L	0.11	0.15	0.14	0.12	0.10	0.11	0.10	0.10	0.08	0.09	0.09
CBR	0.46	0.48	0.27	0.54	0.62	0.56	0.55	0.55	0.70	0.61	0.71
HHI	5556	3600	6800	5200	4400	2800	2800	2500	2000	3600	2800

Table 2 - NHL HHI

	1967 1970	1970 1975	1975 1980	1980 1985	1985 1990	1990 1995	1995 2000	2000 2005	2005 2010	2010 2015	2015 2020
VEG											
COL							0.04	0.0625			
TBL								0.0625			0.04
STL											0.04
WSH											0.04
PIT						0.16			0.04		0.16
CHI									0.04	0.16	
LAK										0.16	
BOS	0.11	0.04								0.04	
DET							0.16	0.0625	0.04		
ANA									0.04		
CAR									0.04		
NJD						0.04	0.04	0.0625			
DAL							0.04				
NYR						0.04					
MTL	0.44	0.16	0.64		0.04	0.04					
EDM				0.16	0.36						
CGY					0.04						
NYI			0.04	0.36							
PHI		0.16									
HHI	5555	3600	6800	5200	4400	2800	2800	2500	2000	3600	2800

Table 3 - NFL Analysis

	1971 1975	1976 1980	1981 1985	1986 1990	1991 1995	1996 2000	2001 2005	2006 2010	2011 2015	2016 2020
σ L	0.21	0.21	0.19	0.18	0.19	0.18	0.19	0.20	0.19	0.19
CBR	0.62	0.68	0.75	0.69	0.67	0.75	0.74	0.72	0.74	0.72
HHI	2800	4400	2800	2800	2800	2800	4400	2800	2000	2800

Table 4 - NFL HHI

	1971 1975	1976 1980	1981 1985	1986 1990	1991 1995	1996 2000	2001 2005	2006 2010	2011 2015	2016 2020
KAN										0.04
LAR										
TAM							0.04			
NWE							0.36		0.04	0.16
PHI										0.04
DEN						0.16				0.04
SEA									0.04	
BAL	0.04						0.04		0.04	
NYG				0.04	0.04			0.04	0.04	
GNB						0.04			0.04	
NOR								0.04		
PIT	0.04	0.36						0.16		
IND								0.04		
STL						0.04				
DAL	0.04	0.04			0.16	0.04				
SFO			0.16	0.16	0.04					
WAS			0.04	0.04	0.04					
CHI				0.04						
RAI			0.04							
OAK		0.04	0.04							
MIA	0.16									
HHI	2800	4400	2800	2800	2800	2800	4400	2800	2000	2800

Table 5 - NBA Analysis

	1976 1980	1981 1985	1986 1990	1991 1995	1996 2000	2001 2005	2006 2010	2011 2015	2016 2020
σ L	0.12	0.14	0.16	0.16	0.17	0.14	0.15	0.16	0.15
CBR	0.62	0.54	0.47	0.56	0.55	0.61	0.64	0.61	0.63
HHI	2500	3600	3600	5200	4400	3600	2800	2800	2800

Table 6 - NBA HHI

	1976 1980	1980 1985	1985 1990	1990 1995	1995 2000	2000 2005	2005 2010	2010 2015	2015 2020
DEN									
GSW								0.04	0.16
MIL									
LAL	0.06	0.16	0.16		0.04	0.16	0.16		0.04
TOR									0.04
CLE									0.04
SAS					0.04	0.16	0.04	0.04	
MIA							0.04	0.16	
DAL								0.04	
BOS		0.16	0.04				0.04		
DET			0.16			0.04			
CHI				0.36	0.36				
HOU				0.16					
PHI		0.04							
SEA	0.06								
WSB	0.06								
POR	0.06								
HHI	2500	3600	3600	5200	4400	3600	2800	2800	2800

Table 7 - MLB Analysis

		1961 1965	1966 1970	1971 1975	1976 1980	1981 1985	1986 1990	1991 1995	1996 2000	2001 2005	2006 2010	2011 2015	2016 2020
MLB	**σ L**	0.09	0.07	0.07	0.08	0.07	0.07	0.06	0.07	0.08	0.06	0.07	0.08
	CBR	0.41	0.53	0.55	0.56	0.73	0.73	0.80	0.64	0.59	0.62	0.70	0.70
	HHI	3750	2000	4400	3600	2000	2000	3750	4400	2000	2000	4400	2000
NL	**σ L**	0.09	0.08	0.07	0.07	0.06	0.07	0.07	0.07	0.07	0.06	0.07	0.07
	CBR	0.40	0.55	0.53	0.57	0.76	0.68	0.80	0.73	0.64	0.76	0.65	0.65
	HHI	2500	3600	2800	3600	2800	2800	3750	4400	2000	2800	5200	2800
AL	**σ L**	0.08	0.07	0.07	0.08	0.07	0.06	0.06	0.07	0.09	0.07	0.07	0.08
	CBR	0.42	0.59	0.55	0.58	0.68	0.76	0.84	0.56	0.58	0.54	0.74	0.88
	HHI	10000	2800	5200	4400	2000	2800	3750	5200	4400	2000	2800	2800

Table 8 - MLB HHI

	1961 1965	1966 1970	1971 1975	1976 1980	1981 1985	1986 1990	1991 1995	1996 2000	2001 2005	2006 2010	2011 2015	2016 2020
ARI									0.04			
ATL								0.04				
BAL		0.04	0.04		0.04							
BOS									0.04	0.04	0.04	0.04
CHC												0.04
CHW										0.04		
CIN				0.16			0.06					
CLE												
COL												
DET		0.04			0.04							
MIA												
HOU												0.04
KCR						0.04						0.04
LAD	0.06	0.04			0.04	0.04						
MIL												
MIN						0.04	0.06					
NYM		0.04				0.04						
NYY	0.25			0.16				0.36	0.04	0.04		
OAK			0.36			0.04						
PHI					0.04					0.04		
PIT			0.04	0.04								
SDP												
SEA												
SFG											0.36	
STL	0.06	0.04			0.04					0.04	0.04	
TBR												
TEX												
TOR							0.25					
WSN												0.04
FLA								0.04	0.04			
TBD												
ANA									0.04			
HHI	3750	2000	4400	3600	2000	2000	3750	4400	2000	2000	4400	2000

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