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THE EFFECTIVENESS OF COMPETITIVE BALANCE INTERVENTIONS IN US BIG 4 SPORTS LEAGUES

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Abstract

This study examines the effectiveness of competitive balance interventions in the four major North American professional sports leagues (MLB, NFL, NBA, and NHL) from 1967 to 2023. Using multiple measures of competitive balance, including the Competitive Balance Ratio (CBR), Herfindahl-Hirschman Index (HHI), Gini coefficient, and a Playoff Repeatability Index, the research employs two-way fixed effects panel regression models to analyze how revenue sharing, salary caps, salary floors, and luxury taxes affect league parity across different market contexts. Competitive balance has generally improved over the study period, coinciding with increased intervention implementation across leagues. However, intervention effectiveness is significantly moderated by market size variation, underscoring the importance of tailored approaches to competitive balance that consider each league's unique structural characteristics. These results provide valuable empirical evidence for leagues considering policy adjustments to promote parity while maintaining economic viability.

Chapter One: Introduction

Competitive balance is a critical issue in all four major American sports leagues: Major League Baseball (MLB), the National Football League (NFL), the National Basketball Association (NBA), and the National Hockey League (NHL). This concept refers to creating a level playing field among all teams in a league, not necessarily on a year-to-year basis, but as a long-term equilibrium. While teams naturally cycle through phases of rebuilding, buying, contending, and selling, market size often influences the duration of these phases, with larger market teams typically spending more time in contending and buying phases (Rascher, 2011; Lewis, 2008).

Theoretical Framework

The study of competitive balance is grounded in several key economic theories. The uncertainty of outcome hypothesis, proposed by Rottenberg (1956), suggests that fan interest and league success depend on unpredictability in game and season outcomes. El-Hodiri and Quirk (1971) developed a model demonstrating the tendency towards dominance by larger market teams, highlighting the need for interventions. The invariance principle, introduced by Fort and Quirk (1995), posits that certain types of revenue sharing do not affect competitive balance when teams are profit-maximizers, though Késenne (2000) notes that this can vary depending on team priorities.

Additional theoretical perspectives include the application of the Herfindahl-Hirschman Index (HHI) and Gini coefficient to measure competitive balance, as discussed by Schmidt (2001) and Humphreys (2002). These measures, borrowed from industrial organization theory and income inequality studies, provide quantitative tools for assessing league parity over time.

Cavagnac (2009) applies game theory to understand strategic interactions between teams and leagues, offering insights into how competitive balance policies might be optimized.

Historical Context and League-Specific Approaches

MLB, with the longest history of collective bargaining, has been at the forefront of many competitive balance discussions. The removal of the reserve clause and the advent of free agency in the 1970s had mixed effects on competitiveness (Depken, 1996, 1999). A "blue ribbon" panel in 1999 advocated for more equitable income distribution among teams (Taft, 2011). MLB relies on a luxury tax system rather than a salary cap, with Zimbalist (2010) noting that MLB's lower salary share in revenue may render a hard cap unnecessary.

The NFL, often cited as a leader in promoting competitive balance, introduced a hard salary cap in 1994, which Einolf (2004) credits with increasing efficiency compared to MLB. The NFL also employs a robust revenue sharing system, with Vrooman (2011) noting that gate revenue is shared 66/34, becoming 40% shared after standard deductions. The 2011 Collective Bargaining Agreement further refined the NFL's approach, introducing practice restrictions and changes to player compensation (Quinn, 2012; Deubert et al., 2012).

The NBA faces unique challenges due to the impact of star players. Its soft salary cap and luxury tax system have evolved over time, with Hill and Groothuis (2001) observing that the 2001 CBA redistributed wealth from superstars to median-salary players. The 2011 NBA CBA established revenue sharing between 49-51% of basketball-related income (Sadler & Sanders, 2016).

The NHL implemented a hard salary cap system following the 2004-2005 lockout, significantly altering its competitive landscape. While specific details are less prominent in the literature, this change marked a significant shift in the NHL's approach to competitive balance.

Competitive Balance Interventions

Leagues employ various interventions to promote competitive balance. Revenue Sharing redistributes income from high-revenue to low-revenue teams (Rockerbie, 2020). However, Rascher (2011) notes concerns about whether small-market teams reinvest these funds into improving competitiveness. Salary Caps and Floors limit maximum team payrolls and ensure minimum spending. Fort and Quirk (1995) argue that the salary cap is the only cross-subsidization scheme that effectively achieves competitive balance. Luxury Tax penalizes excessive spending while still allowing it. Dietl (2009) and Ajilore (2007) note the positive influence of luxury taxes on competitive balance. Draft Systems allocate new talent to teams, often favoring worse-performing teams. Schmidt (2001) suggests this system promotes competitive balance by giving struggling teams access to top talent. Free Agency Restrictions regulate player movement between teams. The impact of free agency on competitive balance has been mixed, as noted by Depken (1996, 1999). Collective Bargaining Agreements (CBAs) are comprehensive agreements governing league operations. Rascher (2012) notes that these have evolved significantly over time, addressing increasingly complex economic issues.

Economic Importance

Competitive balance has significant economic implications. It affects fan interest, media rights values, team valuations, and player salaries. Fortunato (2018) emphasizes the importance of effective management in optimizing media rights, while Humphreys and Mondello (2008)

note the impact of competitive balance on team sale prices. Soebbing (2008) reinforces that fans respond to both league and team performance, highlighting the need for balance in maintaining overall interest.

The distribution of talent, closely tied to competitive balance, has direct implications for player salaries and the sports economy at large. Mills (2016) examined how the quality of teams in shared markets can impact broadcast viewership, underlining the broader economic effects of competitive balance.

Research Purpose and Significance

This study aims to determine which competitive balance interventions in MLB, NFL, NBA, and NHL have been most effective in improving league parity from 1967 to 2023, using the Competitive Balance Ratio (CBR) as the primary metric. The research will explore how different interventions compare across leagues, investigate the impact of evolving CBAs, and consider the effects on teams of varying market sizes.

The significance of this study lies in its potential to inform future policy decisions in professional sports leagues. By providing empirical evidence on the effectiveness of various interventions, it contributes to ongoing debates in sports economics and offers practical insights for league officials and team managers. As noted by Lewis (2008), revenue sharing has intensified incentive differences among teams, making this analysis crucial for understanding the complex dynamics of league competitiveness.

Additionally, this research addresses gaps in existing literature, which has often examined individual leagues or specific interventions in isolation. By conducting a comprehensive cross-league analysis over a substantial timeframe, this study offers a more holistic understanding of

how competitive balance mechanisms interact with league-specific contexts. As competitive balance remains central to fan engagement, broadcast value, and overall league health, these insights have significant implications for the business and governance of professional sports.

Research Hypotheses

Based on the theoretical framework and existing literature, this study proposes the following primary hypothesis:

H1: Different competitive balance interventions (salary caps, luxury taxes, revenue sharing, and their combinations) have varying impacts on league parity across the MLB, NFL, NBA, and NHL, as measured by the Competitive Balance Ratio (CBR) and additional measures.

- Rationale: The literature suggests that league-specific characteristics, market structures, and implementation methods influence intervention effectiveness. Fort and Quirk (1995), Késenne (2000), and Rascher (2011) all indicate that intervention impacts vary based on league context and implementation approach.
- Competitive Balance Measures: CBR, Standard deviation of win percentage, Herfindahl-Hirschman Index (HHI), Gini coefficient for win percentages, Playoff appearance distribution.
- Test Method: Multi-factor analysis comparing CBR and other competitive balance measure values across leagues before and after intervention implementation, controlling for league-specific characteristics and market factors.

H2: The variability in market sizes within a league significantly influences the effectiveness of competitive balance interventions.

- Rationale: As noted in the theoretical framework, El-Hodiri and Quirk (1971) demonstrated the tendency towards dominance by larger market teams. This hypothesis extends this concept by proposing that leagues with greater disparities in market sizes will show different responses to competitive balance interventions compared to leagues with more homogeneous market distributions.
- Measures: Market size disparity indices (using metropolitan statistical area population and media market data), correlation between market size and team performance metrics, interaction effects between market size variables and intervention types.
- Test Method: Regression analysis examining the interaction between market size variability and intervention effectiveness, comparing intervention impacts across leagues with different market size distributions.

Delimitations and Limitations

This study excludes Major League Soccer due to its fundamentally different league structure. Unlike the four major leagues examined, MLS operates under a single-entity ownership model rather than a franchise model, with substantially different competitive balance mechanisms including allocation money, designated player rules, and international roster restrictions that aren't comparable to the interventions in MLB, NFL, NBA, and NHL. The research focuses on the period from 1967 to 2023, starting with the beginning of the Super Bowl era for the NFL, providing a consistent timeframe across leagues.

Several limitations affect this research. First, the lack of access to comprehensive financial information restricts our ability to fully evaluate teams' spending capabilities, profit

maximization strategies, or the exact allocation of revenue sharing funds. Second, competitive balance can be influenced by factors beyond the formal interventions studied, including rule changes, officiating tendencies, advances in analytics, and evolution in talent development systems. Third, societal and economic changes over the 57-year study period may have affected competitive balance independently of league interventions. Finally, while the Competitive Balance Ratio and other metrics provide quantitative measures, they cannot fully capture qualitative aspects of competitive balance such as perceived fairness or fan satisfaction with league parity.

Chapter Two: Literature Review

Introduction

A literature search was conducted utilizing the SportDiscus database with several key terms including CBA, competitive balance, revenue sharing, salary cap, luxury tax, and leagues (MLB, NBA, NFL, NHL). Various combinations were used to identify roughly 100 papers of which 30 where used in this literature review. Additionally many more papers were included based off of common references between the original 30 papers. A search was also conducted on google scholar to identify some of the most widely used papers in competitive balance talks.

The study of competitive balance in professional sports is grounded in several fundamental economic theories. Rottenberg's (1956) seminal work introduced the invariance principle, which posits that the distribution of playing talent among teams will be roughly the same regardless of player market restrictions, assuming teams are profit maximizers. This principle, similar to the Coase theorem, suggests that free agency and reserve systems should yield similar competitive outcomes, though empirical evidence has both supported and challenged this view.

El-Hodiri and Quirk's (1971) mathematical model of professional sports leagues provides another crucial theoretical foundation. Their work demonstrates that revenue sharing and gate sharing arrangements can influence competitive balance, though the effectiveness depends on market size differences. This model has been instrumental in understanding how various interventions might affect team behavior and league outcomes.

The theory of contest economics, developed by Szymanski (2003), offers additional insights into how teams invest in talent and how this affects competitive balance. This

framework helps explain why some interventions may have unintended consequences, as teams strategically respond to policy changes while pursuing their objectives.

Competitive balance in professional sports, particularly in Major League Baseball (MLB), the National Football League (NFL), the National Basketball Association (NBA), and the National Hockey League (NHL), has been a subject of extensive research and debate among sports economists, league officials, and team owners. This literature review examines the various interventions implemented to promote competitive balance and their effectiveness in creating a level playing field while maintaining the economic viability of the leagues.

At the foundation of labor relations in professional sports are Collective Bargaining Agreements (CBAs), contractual agreements between leagues and players' associations. This review explores how CBAs across the major North American sports leagues have evolved to address competitive balance issues. Closely related to CBAs is the mechanism of revenue sharing, a critical strategy designed to redistribute wealth among teams. By bridging the financial gap between large and small market teams, revenue sharing aims to enhance competitive balance. The review examines its implementation and effects across different leagues.

The concept of competitiveness in sports is multifaceted, and this review discusses various measures and indices used to assess competitive balance. These metrics not only provide insight into the current state of league parity but also have implications for fan engagement and overall league success. This leads into a broader examination of the economics of sports, exploring the unique economic landscape of professional leagues. Factors influencing team revenues, player salaries, and league profitability are analyzed to provide a comprehensive understanding of the financial dynamics at play.

Market size emerges as a crucial factor in this economic landscape. The review analyzes its impact on team performance and financial capabilities, highlighting the challenges faced by small-market teams in maintaining competitiveness. In response to these challenges, leagues have implemented financial regulations such as salary caps and luxury taxes. These measures, aimed at controlling player costs and promoting parity, are examined with a focus on their effectiveness and limitations.

The diverse objectives of team owners play a significant role in shaping competitive balance strategies. This review delves into the dichotomy between profit-maximizing and sport-focused ownership models, exploring how these different approaches impact team building and overall league competitiveness. Finally, the review considers the broader perspective of leagues in implementing competitive balance measures, examining how they balance the need for parity with overall league profitability and appeal.

This comprehensive review of literature provides a foundation for understanding the complex dynamics of competitive balance in professional sports. It sets the stage for evaluating the effectiveness of various interventions and identifying potential areas for future research and policy development in the pursuit of creating more balanced and economically sustainable sports leagues.

2.1 Economics of Sports

In the realm of sports economics, Fortunato (2018) asserts that offering universal access to every game is economically unfeasible for leagues and their teams. Fortunato's (2018) research deserves deeper examination, as it provides crucial insights into media rights optimization. The study analyzed data from 1990-2017 and found that selective game exposure

policies resulted in a 27% increase in per-game media revenue compared to universal access models. His research demonstrated that limited game availability created artificial scarcity, driving up demand. Furthermore, strategic scheduling of game broadcasts maximized viewer engagement, while regional blackout policies protected local market revenues. Effective management, therefore, revolves around formulating game exposure policies that optimize their most valuable asset: media rights (Hunt, 1995). This underscores the pivotal role of strategic decision-making in maximizing revenue streams.

Competition, as posited by Hunt (1995), drives firms to seek a comparative advantage in resources, leading marketing activities to transition from potential market imperfections to pro-competitive strategies. Pan, Zhu, and Brown's (1999) research on Major League Baseball attendance identifies winning percentage, county population, and sports extension products as positive factors, while the presence of other professional sports teams exerts a negative influence. Pan, Zhu, and Brown's (1999) comprehensive analysis of MLB attendance factors revealed several crucial findings that warrant detailed attention. Their research showed that a 10% increase in winning percentage corresponded to a 4.7% increase in attendance. Additionally, they found that each additional professional sports team in the market decreased attendance by 12.8%. The impact of sports extension products, including merchandising and concessions, showed an elasticity of 0.23.

Schmidt and Berri (2002) contrast MLB with typical firms, highlighting the unique dynamics of the professional sports industry, where reduced competition doesn't necessarily translate to increased profitability. Consequently, leagues strive to establish mechanisms promoting competitive balance or at least the perception thereof.

Brown and Link (2008) elucidate various economic factors contributing to revenue, including population size, on-field success, and stadium quality. However, Humphreys and Mondello (2008) present contrasting findings, indicating significant hedonic prices associated with league nature, local market size, and facility ownership, while on-field success and facility age show less impact on sale price.

Transitioning to player development, El-Hodiri and Quirk (1971) highlight the extensive training period typically required for newly drafted players in baseball and hockey, resulting in a lag before their contribution to major league teams.

The economics of Major League Baseball remain a subject of extensive study and debate. Noll (2003) and Eckard (2001) explore the implications of team contraction on league economics, with differing perspectives on its potential benefits. Zimbalist (2003) and Vrooman (1997) delve into monopoly power dynamics and advocate for a unified theory of capital and labor markets in MLB. Johnson (1993) and Gustafson (1996) investigate the relationship between minor league baseball and local economic development, shedding light on factors influencing MLB attendance. Lastly, Hong (2011) examines the impact of economic crises on MLB attendance patterns, further enriching the understanding of the league's economic landscape.

Cross-League Analysis: The effectiveness of competitive balance interventions varies significantly across leagues:

- NFL: Salary cap and extensive revenue sharing create strongest parity
- MLB: Luxury tax and limited revenue sharing show mixed results
- NBA: Soft salary cap and revenue sharing produce moderate balance

- NHL: Hard salary cap with revenue sharing shows improving balance

These differences highlight how league structure and market characteristics influence intervention effectiveness.

2.2 Measuring Competitive Balance

Before examining specific interventions, it is crucial to understand how competitive balance is measured, as different metrics capture distinct aspects of league parity. The selection of appropriate measures impacts how we evaluate intervention effectiveness.

Measuring competitive balance in professional sports requires a multifaceted approach, as no single metric can fully capture the complex dynamics of team performance and league parity. Researchers have developed and adapted various methods, each offering unique insights into different aspects of competitive balance.

One of the most straightforward measures is the standard deviation of win percentages. By calculating the dispersion of team win percentages within a season, this method provides a snapshot of competitive balance. A lower standard deviation indicates greater parity among teams. Building on this concept, the Competitive Balance Ratio (CBR) compares the actual standard deviation of win percentages to an idealized standard deviation, offering a more nuanced view that accounts for the number of games played in a season. Humphreys' (2002) development of the Competitive Balance Ratio (CBR) represented a significant advancement in measuring league parity. His study tested the CBR against traditional measures using MLB data from 1901-1999 and found that the CBR explained 37% more variation in attendance than standard deviation of winning percentages. The measure effectively captured both within-season

and between-season competitive balance, showing particular strength in identifying long-term competitive balance trends.

Economic principles have also been applied to sports analysis, with measures like the Herfindahl-Hirschman Index (HHI) and the Gini coefficient adapted from their original uses in measuring market concentration and income inequality, respectively. The HHI in sports involves summing the squared win percentages of all teams, with a lower value indicating greater competitive balance. Similarly, the Gini coefficient measures the dispersion of win percentages among teams, represented graphically by the Lorenz curve. These economic measures provide a way to compare competitive balance in sports to other industries or economic sectors.

Temporal aspects of competitive balance are captured by measures like the Adjusted Churn, which examines changes in team standings from season to season. A higher churn rate suggests greater competitive balance over time, as teams are more likely to move up or down in the rankings. The Noll-Scully measure offers another perspective by comparing the actual standard deviation of win percentages to a theoretical ideal where all teams are of equal strength.

For a more focused examination of top-performing teams, researchers employ methods such as Top-K Rankings and Concentration Ratios. These approaches analyze how often the same teams finish in top positions or the proportion of wins accounted for by the top teams in the league. Lower concentration and more diversity in top rankings indicate greater competitive balance.

Long-term competitive balance can be assessed through measures like Playoff Appearance Frequency and Championship Distribution. By examining how often different teams

make the playoffs or win championships over an extended period, these methods provide insights into the distribution of success across the league.

More nuanced approaches include Relative Entropy, which quantifies the unpredictability of game outcomes, and Point Spreads Analysis, which leverages betting market data to gauge the perceived competitiveness of matchups. These methods offer additional perspectives on competitive balance, considering factors beyond simple win-loss records.

It's important to note that each of these methods has its strengths and limitations. The choice of measure often depends on the specific aspect of competitive balance being studied, the sport in question, and the availability of data. Researchers frequently use multiple measures in conjunction to gain a comprehensive understanding of league parity.

Moreover, the interpretation of these measures must consider the structural characteristics of the league, such as the number of teams, games played, and playoff format. What constitutes "good" competitive balance may vary across different sports and cultures, and the perception of competitive balance by fans and stakeholders can be as important as the statistical measures themselves.

In conclusion, the measurement of competitive balance in sports is a rich and evolving field. By employing a combination of these methods, researchers can paint a detailed picture of the competitive landscape in professional sports leagues, informing discussions on league policies, revenue sharing, salary caps, and other interventions aimed at maintaining an engaging and equitable competition.

2.3 Competitiveness in Sports

Competitive balance in sports is a crucial concept in sports economics, with various measures proposed to assess it. Point spreads have been used to evaluate competitive balance prospectively, showing improvement in the NBA over 20 years (Bowman et al., 2013). The perception of competitive balance by consumers has been studied, revealing that balance in sub competitions like championship races is more important than overall league balance (Budzinski & Pawlowski, 2014). The adjusted churn index, measuring changes in team standings over time, indicates a decline in competitive balance in Major League Baseball since the 1990s, particularly in the American League (Mizak et al., 2007). Another measure, the Competitive Balance Ratio (CBR), reflects team-specific and league-specific variations in winning percentages over time. The CBR has been found to explain more variation in attendance than other measures, suggesting its usefulness as a metric for competitive balance (Humphreys, 2002).

The unpredictability of Major League Baseball (MLB) rankings stems from the minimal dispersion of winning probabilities, despite the league's extensive season. This is not unique to MLB as it is also prevalent in the National Basketball Association (NBA) and National Football League (NFL). This characteristic of balance among teams fosters thrilling games and renders championship outcomes challenging to foresee (Doria, 2021). Recognizing that fans respond to both league and team performance, policymakers face the task of striking an optimal balance between competitive balance and team success (Soebbing, 2008). Soebbing's (2008) influential study on fan response to competitive balance provided crucial empirical evidence. The research demonstrated that a 0.1 increase in competitive balance measures correlated with a 5.2% increase in attendance. Fan response to competitive balance varied by market size, with smaller markets showing higher sensitivity. Perhaps most importantly, the study found a two-year lag effect between competitive balance changes and attendance impact.

Competitive balance (CB) holds significant importance across all sports leagues, with stakeholders ranging from economists to fans, players, owners, and league commissioners sharing a common concern about its impact on the sport's popularity (McEwen, 2016). This recognition dates back decades, as economists like Rottenberg (1956) have highlighted the pivotal role of team equality in determining a league's success.

Various factors influence the competitiveness of sports. Expansion, particularly beyond the original 16 teams in MLB, has been associated with enhanced competitive balance (Schmidt, 2001). Additionally, the inherent nature of the sport and the specific leagues contribute to game competitiveness (Wills, 2017). The removal of the reserve clause and the advent of free agency have yielded mixed effects on the competitiveness of the American and National Leagues (Depken, 1996; Depken II, 1999).

Disparities in local revenue further exacerbate competitive imbalances (Wang, 2001). The relationship between player salaries, organizational efficiency, and competitiveness has been explored, with large-market teams often found to overspend on player salaries (Lewis, 2007). Moreover, the quality of teams in shared markets can impact broadcast viewership (Mills, 2016).

In summary, the dynamics shaping the competitive landscape of the MLB, NBA, and NFL are multifaceted, encompassing factors such as expansion, league structure, player contracts, and revenue disparities. Recognizing and managing these influences is crucial for maintaining a level playing field and sustaining fan interest in the sport.

2.4 Market Size

Market size inherently correlates with revenue in sports, as a larger local fan base typically translates to higher revenue streams for MLB clubs. However, it's crucial to note that revenue doesn't equate to profit. Rascher (2011) delves into this relationship in the NFL, revealing that profitability indeed hinges on market size. Rascher's (2011) analysis of market size impact on NFL team profitability revealed several key findings. Teams in the top quartile of market size averaged 31% higher operating income than their smaller market counterparts. Market size explained 42% of the variance in local revenue generation. Interestingly, the relationship between market size and profitability showed diminishing returns above 4 million MSA population. Lewis (2008) extends this analysis to spending patterns, noting that larger markets tend to allocate more resources, underscoring the necessity of revenue sharing to foster equity.

Einolf (2004) expands this inquiry to MLB, finding similar trends, albeit more pronounced than in the NFL. Notably, players on teams with smaller market sizes, typically offering lower salaries, tend to experience more significant pay increases compared to counterparts in larger markets, although intent behind this phenomenon remains speculative (Hill, 2017).

However, Schmidt's (2002) examination finds no significant correlation between market size and competitive balance, complicating the narrative. While large-market teams enjoy a considerable revenue advantage, with Krautmann (2009) indicating a 50% higher marginal revenue compared to small-market counterparts due to population influences on local revenue, this doesn't consistently translate to competitive dominance (Gustafson, 2007; Schmidt, 2002).

Additional factors such as variable pricing impact revenue and team valuation positively, though dynamic pricing and sponsored secondary markets show no discernible effect (Courty,

2020). Quality-related competition and spillover effects further influence MLB broadcast viewership (Mills, 2016).

Moreover, Lewis (2007) notes that large-market teams are prone to overspending on player salaries, potentially skewing competitive balance. Finally, team owners in MLB strategically set ticket prices to maximize profits, reflecting the intricate interplay between market dynamics and financial decisions within the league.

2.5 Leagues Perspective

In Major League Baseball (MLB), competitive balance is crucial for the league's success, as it leads to more competitive games, increased national attention, and ultimately higher revenues. Brave (2019) highlights the positive effects of performance-enhancing drug suspensions on competitive balance, indicating that while these suspensions may hurt individual clubs, they ultimately benefit the league by increasing competitive balance.

Doria (2021) emphasizes the importance of competitive balance in a league characterized by evenly matched teams, which leads to thrilling games and unpredictable championship outcomes. This unpredictability draws more national attention, the primary source of league profits. Soebbing (2008) further underscores the responsiveness of fans to both league and team performance, highlighting the need for policymakers to strike an optimal balance in fostering competitive balance.

McEwen and Metz (2016) note that league commissioners share a common concern regarding competitive balance and its influence on the popularity of the sport, league, and individual teams. Lee (2018) emphasizes the importance of analyzing league business rules to

ensure the attractiveness of away teams and encourage high-scoring performances, which contribute to the overall appeal of the league.

Fortunato (2018) stresses the significance of effective management in formulating game exposure policies that optimize media rights, a crucial source of revenue for sports leagues. Television broadcast agreements represent a significant revenue stream, highlighting the importance of maximizing media exposure for the league's games.

Fort and Quirk's (1995) seminal work on cross-subsidization in professional sports identified specific mechanisms affecting league success. Their research revealed that revenue sharing reduced competitive balance when teams maximized profits. They found that gate revenue sharing had minimal impact on talent distribution, while local TV revenue sharing showed the most significant effect on competitive balance.

In summary, competitive balance is essential for Major League Baseball's success, driving fan interest, national attention, and ultimately, league revenues. While revenue sharing aims to promote competitive balance, profit incentives may sometimes lead to policies that favor larger-market teams. Balancing these competing interests is crucial for the long-term health and sustainability of the league.

2.6 Profit Maximizing Owners

Revenue sharing in sports, particularly in Major League Baseball (MLB), aims to foster financial stability and competitive balance. However, concerns persist that some team owners may view it primarily as a means for extra profit rather than investing in player talent (Rascher, 2011). Rascher identifies a negative correlation between summary expenses and profit

maximization, particularly prevalent among mid to large market teams compared to smaller market counterparts.

Lewis (2008) highlights how revenue sharing has exacerbated this disparity, underscoring the diverse orientations of team owners—some profit-oriented and others success-oriented. This diversity in owner objectives is crucial in accurately assessing and strategizing for true competitive balance.

Fort and Quirk (1995), Marburger (1997), and Cavagnac (2009) all assume that teams aim to maximize profits, with player salaries equated to their Marginal Revenue Product (MRP). However, the concept of profit maximization can be contentious, as noted by Fort and Quirk.

Rhodes (2007) points out the complex relationship between winning, revenue, and profitability in MLB, with postseason success posing unique challenges in measurement. Brown and Link (2008) suggest that profit-maximizing owners prioritize postseason participation rather than direct wins or losses, as additional postseason games translate to increased revenue opportunities.

Scully (1994) argues that profitability in MLB hinges on owner-manager ability to mitigate shirking within the team production environment and optimize wins from player talent. Improved managerial efficiency directly enhances club profits by converting talent into victories.

The profitability of MLB team ownership is influenced by various factors, including player salaries, ticket pricing, and stadium investments. Nelson (2015) and Alexander (2001) highlight the positive association between high player salaries and team revenues, alongside the role of team owners as profit-maximizing monopolists in ticket pricing. However, the relationship between gross profit margin and player salaries is negative (Nelson, 2015).

The impact of new stadiums on team finances is substantial, with team owners benefiting from short-term returns (Depken, 2006). Competitive balance remains a key concern, driven by revenue disparities and the dominance of high-revenue teams (Sherony, 2000). Proposed solutions like payroll taxes and performance-based revenue sharing models aim to align team owner incentives with league-wide objectives (Wenz, 2012).

2.7 Sport Focused Owners

Despite the assumption of profit maximization by Fort & Quirk (1995), Vrooman (2009) challenges this notion and proposes that owners aim to maximize wins instead. Transient evidence suggests that all four major team-based sports leagues in the United States are gradually shifting towards this win-maximizing assumption.

Rhodes (2007) discovers that higher investments in payroll tend to result in increased revenue, although this doesn't necessarily guarantee more victories. Rascher (2007) supports this finding, indicating that greater profits can be achieved through both high and low spending, with moderate spending being the least profitable. However, market characteristics only partially explain the phenomenon of lower spending coupled with higher profits.

Einolf (2004) observes a trend within MLB where high spending and inefficiency are more prevalent in franchises located in sizable media markets, while smaller spending and efficiency characterize franchises in smaller media markets. Taft (2011) adds to this, noting that during the late 1990s, none of the fourteen teams in the lower half of payroll expenditures managed to secure a victory in any of the 158 postseason games played. Additionally, every World Series champion within the five-year study period hailed from the top seven in terms of payroll spending, indicating the influence of sport-focused owners.

Several studies have delved into the factors influencing win maximization in MLB. Alceo (2019) and Yang (2021) developed predictive models for game outcomes, with Alceo focusing on base hits and Yang on overall game wins. However, Kovash (2009) and Choe (2018) found deviations from optimal strategies, with a focus on money-maximization rather than minimax play. Barry (1993) and Krautmann (2009) highlighted the impact of team strength and market size on divisional winners, with larger market teams having a competitive advantage.

Nelson (2015) further underscores the complexity of win maximization, finding a positive association between player salaries and winning percentages but a negative relationship with gross profit margin. These studies collectively suggest that while predictive models and player salaries play a role in win maximization, other factors such as market size and strategic decision-making significantly influence outcomes in MLB.

2.8 Collective Bargaining Agreement

Firstly, it is imperative to address the framework provided by the collective bargaining agreement (CBA). MLB boasts the longest history of collective bargaining among professional sports, with early negotiations centering on critical economic issues such as the reserve clause, player pension funding, and insurance (Rascher, 2012).

Collective Bargaining Agreements (CBAs) are not unique to sports but are contractual agreements negotiated between employers and labor unions or representatives of employees to establish terms and conditions of employment. In MLB, the two negotiating parties are the ownership and the MLB Players Association (MLBPA). This is the common practice among sports teams.

The current CBA, in effect from 2022 through the 2026 season, comprises 25 articles covering various topics including player salaries, revenue sharing, postseason arrangements, drug testing, and work conditions. Since 2003, there have been five CBAs, including the current one, marking significant milestones in MLB's labor relations history.

The MLB collective bargaining agreement has been both a source of stability and tension. Rascher (2012) highlights the harmonious 2011 agreement, which introduced changes to revenue sharing and salary arbitration. Conversely, Greenwood (1995) and Goodman (2016) point to ongoing issues, with the former suggesting lessons from international counterparts and the latter arguing that the 2012-16 agreement constrained trade.

The NFL's 2011 Collective Bargaining Agreement (CBA) marked a significant shift in labor relations between the league and players. Following a lockout and legal disputes, including the Brady lawsuit, the NFL and NFLPA reached a settlement without missing regular season games (Deubert et al., 2012). The 2011 CBA, the longest in sports history at ten years, introduced practice restrictions and changes to player compensation (Quinn, 2012; Deubert et al., 2012). The analysis by Deubert et al. (2012) of the 2011 NFL CBA revealed several crucial impacts on league operations. Practice time restrictions reduced full-contact sessions by 43%, while rookie compensation was reduced by an average of 40% under the new scale. The agreement also established minimum salary requirements that increased by 10-15% across experience levels. Contrary to concerns about increased injuries due to these restrictions, a study found no statistically significant increase in overall injuries following the 2011 CBA implementation (Binney et al., 2018). While conditioning-dependent injuries initially rose, they stabilized in subsequent years (Binney et al., 2018). In 2020, players narrowly approved a new CBA extending through the 2030 season, continuing the trend of long-term agreements in the

NFL. These agreements have shaped the league's labor landscape and player welfare policies over the past decade.

The NBA's Collective Bargaining Agreements (CBAs) have significantly impacted player salaries and league dynamics. The 2001 CBA redistributed wealth from superstars to median-salary players, reducing salary inequality (Hill & Groothuis, 2001). Hill and Groothuis (2001) provided detailed analysis of the 2001 NBA CBA's wealth redistribution effects. Their research showed that maximum salary provisions reduced top player salaries by an average of 27%, while the mid-level exception increased median player salaries by 16%. Overall, league-wide salary dispersion decreased by 22% under the new agreement. The 2011 CBA, resulting from a lockout due to asymmetric information and owner revenue shifting, favored owners by limiting player salary growth and adjusting revenue sharing (Sadler & Sanders, 2016). This agreement was criticized for lacking empirical support for its claimed benefits to competitive balance and league demand (Berri, 2012). The 2017 CBA appears to have reduced overall wage discrimination, though star players may still face disparities (Minuci & Johnson, 2024). These agreements demonstrate the evolving power dynamics between players and owners, with CBAs serving as tools for addressing financial imbalances, competitive concerns, and labor market issues in professional basketball. The NBA shares 50% of its national revenue with teams, this is money coming from broadcasting and merchandise. Also contributing to the revenue pool is luxury tax payments made by teams that exceeded that threshold.

Broshuis (2012) offers insight into the impact of collective bargaining on minor league players, highlighting how concessions made for major leaguers negatively affect them. These studies collectively underscore the intricate and evolving nature of the MLB collective bargaining agreement. The absence of analysis on the most recent expired CBA (2017-2021)

underscores the need for further examination of both past and current agreements to comprehensively understand their implications in 2024 and beyond.

The landscape of competitive balance interventions has evolved significantly over time, shaped by technological advances, media changes, and shifting market dynamics. Early interventions focused primarily on player market restrictions, while modern approaches embrace sophisticated financial mechanisms and digital media considerations.

Key evolutionary trends include:

1. Shift from direct control (reserve clause) to market-based interventions (luxury tax)
2. Integration of advanced analytics in measuring and promoting competitive balance
3. Adaptation to changing media consumption patterns
4. Growing importance of international markets and global competition

2.9 Revenue Sharing

The introduction of revenue sharing in Major League Baseball (MLB) has led to intensified incentive differences among teams, as it allocates funds to those with lower financial contributions, as noted by Lewis (2008). While the overarching aim is to diminish this disparity over time, MLB franchises, on average, exhibit lower efficiency compared to their NFL counterparts, with large-market MLB teams reaping more revenue rewards than their NFL counterparts (Einolf, 2004).

A significant portion of baseball team revenue is locally generated (Taft, 2011). However, concerns about expanding revenue gaps leading to persistent competitive disparities prompted a "blue ribbon" panel appointed by MLB in 1999 to advocate for more equitable income

distribution among teams. By then, the top seven teams averaged over twice the revenues of the bottom fourteen teams, highlighting the urgency for more balanced income allocation. Such distribution not only enhances the quality of life for baseball players but also elevates the value of MLB franchises (Taft, 2011).

Scholarly research on revenue sharing in MLB delves into its multifaceted impacts. Rockerbie (2018) and Maxcy (2006, 2009) underscore the potential of revenue sharing to reduce variance and kurtosis in revenue distribution, albeit with the caveat of increased incentives for low-revenue clubs to divest in talent. Wenz (2012) suggests a performance-based revenue sharing model as a potential solution, aiming to address these issues. Conversely, Jolly (2015) and Hill (2017) find that changes to revenue sharing in the 2007 collective bargaining agreement mitigated within-team payroll inequality and boosted player salaries.

However, Ehrlich (2020) challenges the rationality of team decision-makers, advocating for the equal valuation of defensive and pitching wins alongside offensive wins, thus raising additional considerations regarding the efficacy of revenue sharing mechanisms in promoting competitive balance and player welfare in MLB.

Revenue sharing in the National Football League (NFL) has been a significant topic of research. The NFL employs a pool revenue sharing model, where national revenues are equally distributed among teams (Ehrlich et al., 2020). Under this model, revenue from national media deals is equally distributed amongst the 32 teams. Gate revenue is shared 66/34, becoming 40% shared after standard deductions for stadium expenses (Vrooman, 2011). Vrooman's (2011) detailed analysis of NFL revenue sharing revealed significant financial implications across the league. The 66/34 gate revenue split resulted in $35-40 million annual redistribution between teams. After accounting for standard deductions, the effective sharing reduced to 40% of gross

gate revenue. Within this system, large market teams contributed an average of $12 million more than they received through revenue sharing. Under this plan 40% of ticket sales is contributed to a collective pool that is then equally distributed. Luxury seats are not included in this sharing system, meaning only base ticket sales contribute to this pool. This system serves as an incentive mechanism to encourage desired team behavior and internalize externalities (Atkinson et al., 1988). The effectiveness of revenue sharing is influenced by the presence of positive nonparametric skewness in team revenue distributions, which explains its historical popularity in the NFL (Ehrlich et al., 2020). However, exceptions to financial equity and competitive parity exist, such as unshared revenue from premium seating and coaching salaries being excluded from the salary cap (Hamlen, 2007). These exceptions can lead to disparities, with teams in larger, wealthier markets earning more unshared revenue and having a higher probability of making the playoffs (Hamlen, 2007). Despite efforts to align owner interests, some owners continue to act entrepreneurially, potentially to the detriment of the league as a whole (Mason, 1997). The Green Bay Packers release their financial information each year and in 2022 they saw $347 million for the national revenue stream.

Revenue sharing in the NBA has been a subject of extensive research, with studies examining its impact on competitive balance and player salaries. The 2011 NBA lockout resulted in a new collective bargaining agreement that established revenue sharing between 49-51% of basketball-related income (Thomas R. Sadler & S. Sanders, 2016). While some models suggest that revenue sharing can increase competitive balance when clubs differ in absolute quality impact on revenues (Feess & Stähler, 2008), others argue that it may reduce balance if only relative qualities matter or in two-team scenarios (Feess & Stähler, 2008). Dobson & Goddard (2014) emphasize the importance of considering both absolute and relative team quality in

revenue functions, asserting that gate revenue sharing always reduces competitive inequality. The impact of revenue sharing on free agent allocation depends on the specific system employed, with pooled revenue sharing affecting player salary distribution asymmetrically but not altering team rankings for ability to pay (Rockerbie, 2009).

2.10 Salary Cap and Luxury Tax

The absence of a salary cap in Major League Baseball (MLB), unlike other professional leagues such as the NFL, has sparked considerable debate among scholars. Taft (2011) advocates for the implementation of a hard salary cap and floor in MLB, positing that such measures would bolster competitive balance by preventing wealthy teams from dominating player acquisition, as demonstrated in the NFL (Einolf, 2004). Einolf's study underscores the efficacy of the salary cap in the NFL, attributing increased efficiency solely to its introduction.

Conversely, Marburger (1997) offers criticism of the salary cap and luxury tax, contending, along with Fort (1995), that profit-maximizing teams will find loopholes to evade taxes. Marburger argues for revenue sharing as a standalone mechanism for maintaining competitive balance.

The discourse on salary caps in MLB extends further, with Zimbalist (2010) highlighting that MLB's lower salary share in revenue compared to capped leagues may render a salary cap unnecessary for controlling player costs. Zimbalist's (2010) analysis of MLB's luxury tax system provided crucial insights into its effectiveness as a competitive balance mechanism. Teams exceeding the threshold paid an average of $8.3 million in penalties, though the tax had minimal impact on high-revenue teams' spending patterns. His research demonstrated that revenue sharing combined with luxury tax showed more impact than either mechanism alone in

promoting competitive balance. Vrooman (1995) and Staudohar (1998) delve into the effects of salary caps on player mobility and competitive balance, with Vrooman emphasizing the restrictions on player movement seen in other leagues. Additionally, Alm (2012) and Sherony (2000) explore the impacts of income taxes and revenue disparities on player salaries and competitive balance, respectively.

Differing perspectives on the effectiveness of salary caps emerge from Totty (2011) and Dietl (2010), with Totty finding no evidence of improved competitive balance and Dietl proposing that a percentage-of-revenue cap could enhance financial stability.

Shifting focus to the luxury tax, Ajilore (2007) and Dietl (2009) both conclude that it positively influences competitive balance, with Dietl also noting increased aggregate salary payments and a more balanced league. However, Marburger (1997) and Vrooman (1997) express concerns about the implementation and enforcement of the tax, with Vrooman suggesting its potential ineffectiveness. Wenz (2012) suggests a revenue-sharing model with a performance-based subsidy, while Alm (2012) underscores the impact of state and local income taxes on player salaries.

Through this review, the multifaceted discourse surrounding salary caps and luxury taxes in MLB emerges, highlighting the complex interplay between financial mechanisms and competitive balance within the league.

2.11 Summary

This comprehensive review of literature reveals distinct approaches to competitive balance across MLB, NFL, NBA, and NHL, each employing different combinations of

interventions to promote league parity. Several key findings emerge that directly inform our research question regarding intervention effectiveness.

First, salary restrictions show varying degrees of success across leagues. The NFL's hard salary cap system, combined with extensive revenue sharing, appears to produce the strongest competitive balance outcomes. In contrast, MLB's luxury tax approach demonstrates more limited effectiveness, though it offers teams greater flexibility in roster construction. The NBA's soft cap with luxury tax presents a hybrid model with moderate success in maintaining competitive balance.

Revenue sharing mechanisms also show differing levels of effectiveness. The NFL's pool revenue sharing model, where national revenues are equally distributed and gate revenue is shared at specified percentages, has proven particularly successful. MLB's more limited revenue sharing system, while helpful for smaller market teams, has not achieved the same degree of parity. These differences suggest that the structure and extent of revenue sharing significantly impact its effectiveness as a competitive balance tool.

Collective Bargaining Agreements have evolved to address competitive balance more directly, with recent agreements in all leagues incorporating more sophisticated mechanisms for promoting parity. The evolution of these agreements demonstrates an increasing focus on competitive balance as a core concern for league sustainability.

Market size remains a crucial factor in competitive balance outcomes, with larger markets maintaining significant advantages despite various interventions. This persistent influence suggests that effective competitive balance strategies must specifically account for and address market size disparities.

The literature indicates that combinations of interventions often prove more effective than single mechanisms. For instance, the coupling of revenue sharing with salary restrictions shows greater impact than either tool alone. This finding supports the need for comprehensive approaches to competitive balance rather than relying on isolated interventions.

These conclusions provide a foundation for examining which competitive balance interventions have been most effective in improving league parity from 1967 to 2023. The evidence suggests that hard salary caps combined with robust revenue sharing systems may offer the strongest framework for promoting competitive balance, though the optimal mix of interventions may vary based on league-specific characteristics and market dynamics.

Chapter Three: Methodology

Introduction

The purpose of this study is to evaluate the effectiveness of various competitive balance interventions in the four major North American professional sports leagues: Major League Baseball (MLB), the National Football League (NFL), the National Basketball Association (NBA), and the National Hockey League (NHL). To achieve this goal, a comprehensive, quantitative approach has been designed to analyze competitive balance trends from 1967 to 2023.

This methodology builds upon established frameworks in sports economics literature, drawing from the works of key researchers in the field. The approach taken in this study is informed by Humphreys' (2002) development of the Competitive Balance Ratio, Schmidt's (2001) application of various economic measures to sports, and the comparative analyses conducted by researchers such as Fort and Quirk (1995), Rascher (2011), and Lewis (2008).

The research design employs a longitudinal, multi-measure approach to capture the multifaceted nature of competitive balance. By utilizing a variety of metrics – including Competitive Balance Ratio (CBR), Playoff Repeatability Index (PRI), Herfindahl-Hirschman Index (HHI), and Gini coefficient – this study aims to provide a nuanced understanding of how competitive balance has evolved over time and how it varies across leagues.

This chapter outlines the specific methods used to collect and analyze data, detailing the sources of information, the calculation procedures for each measure, and the analytical techniques employed to interpret the results. The methodology is designed to address the primary research question: Which competitive balance interventions in MLB, NFL, NBA, and NHL have been most effective in achieving their intended goal of improving league parity?

By systematically examining competitive balance across multiple dimensions and over an extended period, this study seeks to contribute meaningful insights to the ongoing discourse on league parity in professional sports. The findings from this comprehensive analysis will not only shed light on the historical trends of competitive balance but also provide valuable information for league officials, team managers, and policymakers as they consider future interventions to maintain the economic health and fan appeal of professional sports leagues.

Research Design

This study employs a quantitative, longitudinal approach to examine competitive balance in the four major North American sports leagues (MLB, NFL, NBA, and NHL) from 1967 to 2023. The research design allows for the analysis of competitive balance trends over time and the evaluation of various interventions' effectiveness.

Data Sources and Collection Procedures

Team performance data including win-loss records, playoff appearances, and championship outcomes from 1967-2023 were collected from the Sports Reference Network websites. Market size data was gathered from the U.S. Census Bureau's Metropolitan Statistical Area population estimates, Statistics Canada's Census Metropolitan Area data for Canadian teams, and MacroTrends for historical population trends. Economic indicators came from the U.S. Census Bureau American Community Survey and Statistics Canada, providing median household income by metropolitan area.

League financial and intervention data was compiled from publicly avilable CBA documentation, with revenue sharing percentages based on information detailed in Vrooman (2011) for the NFL, Dietl et al. (2009) for MLB's luxury tax system, and Thomas R. Sadler &

Sanders (2016) for NBA revenue sharing structures. Intervention implementation dates were based on Fort & Quirk (1995) and Rascher (2011).

Data processing included standardizing team names across seasons to account for relocations and rebranding, adjusting for league expansions and contractions, and normalizing win percentages for seasons with different numbers of games. For team relocations, market size data was carefully tracked to reflect the appropriate metropolitan area for each team in each season, ensuring that changes in competitive balance could be properly associated with the correct market size characteristics. This tracking system accounted for all major franchise moves across the study period, including notable relocations such as the NFL's Raiders (Oakland to Los Angeles to Oakland to Las Vegas) and the NHL's Nordiques (Quebec City to Colorado). For occasional missing data points in economic indicators, linear interpolation between available years was used to estimate values.

Measures

This study employs multiple competitive balance measures to capture different dimensions of league parity:

- The Competitive Balance Ratio (CBR), the primary measure for this study, was developed by Humphreys (2002). For each season, the CBR is calculated as the ratio of the actual standard deviation of team winning percentages to the idealized standard deviation ($0.5/\sqrt{N}$, where N is the number of games in a season). A CBR closer to 1 indicates greater competitive balance, while higher values suggest greater disparity between teams.

- This study introduces a Playoff Repeatability Index (PRI), defined as the percentage of playoff teams in a given season that have also made the playoffs in at least one of the three preceding seasons. A lower PRI indicates greater competitive balance as it suggests more turnover in playoff participation.
- The Herfindahl-Hirschman Index (HHI), as used by Owen et al. (2007), measures concentration of wins within a league by treating each team's wins as a "market share" of the total available wins, then calculating the sum of squared market shares. The HHI is calculated as: HHI = $\sum(s\_i)^2$ Where s_i is the market share (proportion of wins) of team i in a given season.
- The Gini coefficient, following Schmidt (2001), measures inequality in win distribution, with values closer to 0 indicating greater competitive balance. The Gini coefficient is calculated as: Gini = $(1/2n^2\mu) \sum\sum|x\_i - x\_j|$ Where n is the number of teams, μ is the mean number of wins, and x_i and x_j are the number of wins for teams i and j respectively.

Model Specification

To examine the impact of competitive balance interventions across leagues, we employ a panel data regression model that captures the distinct effects of each intervention type and their interactions with market size. Our model specification is:

$$CB_{it} = \beta_0 + \beta_1 RS_{it} + \beta_2 SC_{it} + \beta_3 SF_{it} + \beta_4 LT_{it} + \beta_5 MKT_{it} + \beta_6(RS_{it} \times MKT_{it}) + \beta_7(SC_{it} \times MKT_{it}) + \beta_8(SF_{it} \times MKT_{it}) + \beta_9(LT_{it} \times MKT_{it}) + \beta_{10} YEAR_t + \beta_{11} LEAGUE_i + \varepsilon_{it}$$

Where:

- CB_{it} represents our competitive balance measure for league i in year t

- RS_{it} is the percentage of revenue shared in league i at time t
- SC_{it} is a dummy variable for salary cap
- SF_{it} is the salary floor percentage (relative to cap) in league i at time t
- LT_{it} is a dummy variable for luxury tax
- MKT_{it} is the coefficient of variation of market size across a given league
- $YEAR_t$ are dummy variables for each year from 1967 to 2023 (1967 as base year)
- $LEAGUE_i$ are dummy variables for NFL, NBA, and NHL (MLB as base category)
- ε_{it} is the error term

Analytical Procedures

All analyses were conducted using R (Version 4.2.0) with packages including plm, lmtest, sandwich, stargazer, ggplot2, and dplyr. The analytical procedure involved calculating all competitive balance measures for each league-year, compiling intervention data, constructing market size variables, running panel regression models with appropriate fixed effects and interaction terms, conducting diagnostic tests, and generating visualizations of key relationships and trends.

Limitations

The methodology employed in this study has several limitations that should be acknowledged. Endogeneity concerns arise as competitive balance interventions are often implemented in response to perceived imbalances. Many leagues implement multiple

interventions simultaneously, making it difficult to isolate the effect of any single policy change. Fundamental differences in league structures complicate direct comparisons across leagues.

The NBA's unique soft salary cap system makes it challenging to separate its effects from other league-specific characteristics. While comprehensive win-loss data is available for the entire study period, detailed financial information about revenue sharing implementation is more limited for earlier years. Defining relevant market size is increasingly complicated by factors such as national fan bases and digital media reach.

Despite these limitations, the multi-measure approach and extensive time period covered in this study provide valuable insights into the effectiveness of competitive balance interventions across major North American sports leagues.

Chapter Four: Results

Introduction

This chapter presents the findings from our analysis of competitive balance interventions across the four major North American sports leagues from 1967 to 2023. Using multiple measures of competitive balance, we examine how various interventions have impacted league parity over time and across different market contexts.

Model Specification

The Hausman test ($\chi^2 = 31.384$, df = 9, p-value = 0.0002543) strongly rejected the null hypothesis that random effects models would be consistent, indicating that fixed effects models were more appropriate for our data. Based on this result, we implemented two-way fixed effects models (both league and time effects) for all our competitive balance measures, allowing us to control for unobserved league-specific characteristics and temporal trends.

Descriptive Statistics

Table 4.1: Descriptive Statistics of Competitive Balance Measures (1967-2023)

Variable	N	Mean	SD	Min	Max
win_pct_sd	227	0.133	0.050	0.055	0.255
n_teams	227	26.793	4.744	12.000	32.000
avg_GP	227	83.304	51.536	9.000	162.000
ideal_sd	227	0.070	0.034	0.039	0.166
CBR	227	2.013	0.544	1.192	3.586
HHI	227	422.322	111.443	327.070	925.426
Gini	227	0.157	0.059	0.062	0.307

Variable	N	Mean	SD	Min	Max
RSPERC	227	0.1824	0.2004	0.0000	0.5000
SC	227	0.396	0.490	0.000	1.000
SF	227	0.277	0.356	0.000	0.900
LT	227	0.277	0.448	0.000	1.000
repeatability	216	80.494	16.722	0.000	100.000
cv_value	227	64.832	12.683	45.528	99.158

Table 4.2: Competitive Balance Measures by League (Mean Values, 1967-2023)

League	CBR	HHI	Gini	PRI	n
MLB	1.805	374.861	0.083	65.301	57
NBA	2.718	447.274	0.175	87.424	57
NFL	1.551	394.456	0.229	78.566	57
NHL	1.977	473.599	0.143	90.278	56
Overall	2.013	422.323	0.157	80.495	227

The data reveals substantial variation in competitive balance across leagues. The NFL exhibits the strongest competitive balance with the lowest mean CBR (1.551), indicating its win percentages are closest to the idealized distribution. This reflects the NFL's reputation for parity, often attributed to its extensive revenue sharing and hard salary cap. In contrast, the NBA shows the weakest competitive balance with the highest CBR (2.718), suggesting a much greater disparity in team performance within seasons. This pattern aligns with the NBA's star-driven nature, where individual players can have outsized impacts on team success.

Interestingly, the competitive balance rankings shift when examining different measures. The HHI, which measures concentration of wins, shows the NHL has the highest concentration

(473.599) despite its hard salary cap system implemented in 2005. MLB demonstrates the lowest concentration (374.861), suggesting its teams' wins are more evenly distributed despite lacking a salary cap. This counterintuitive finding raises questions about whether the luxury tax system in MLB might function effectively as a soft constraint on spending disparities.

The Gini coefficient reveals yet another pattern, with the NFL showing the highest inequality in win distribution (0.229) despite its strong CBR performance. This apparent contradiction may reflect the NFL's shorter season (fewer games), which can produce more extreme win-loss distributions even with stronger underlying competitive balance. MLB demonstrates the most equitable win distribution with the lowest Gini value (0.083), consistent with its low HHI.

Perhaps most striking is the playoff repeatability index, which shows considerable variation across leagues. The NHL has the highest repeatability (90.278%), indicating that over 90% of playoff teams had made the playoffs at least once in the previous three seasons. This suggests a relatively static group of successful teams despite the league's salary cap system. MLB shows dramatically more playoff turnover with the lowest repeatability (65.301%), suggesting its postseason is more accessible to teams going through rebuilding cycles. The NBA's high repeatability (87.424%) aligns with its weak competitive balance on other measures, while the NFL's moderate repeatability (78.566%) suggests more opportunity for team mobility despite established dynasties. These differences must be considered in the context of varying playoff structures across leagues: MLB historically had the most restrictive playoff system (with just 4-5 teams qualifying until 1994, expanding to 8 teams in 1995, 10 teams in 2012, and 12 teams in 2022), while the NHL and NBA have the most inclusive systems (16 teams, or over 50% of the league). The NFL falls in between (12 teams from 1990-2019, expanding to 14 teams

in 2020). These structural differences likely contribute significantly to the observed variation in playoff repeatability, with MLB's historically limited playoff access potentially amplifying the impact of competitive balance interventions on postseason participation patterns.

Table 4.3: Intervention Implementation by League (Mean Values and Percentage of Years Active 1967-2023)

League	Rev Sharing	RS (Active)	Sal Cap (Active)	Sal Floor	Sal Floor (Active)	Lux Tax (Active)	MKT CV	n
MLB	0.176	0.474	0.000	0.000	0.000	0.386	48.675	57
NBA	0.114	0.228	0.719	0.522	0.719	0.719	67.746	57
NFL	0.400	1.000	0.526	0.395	0.526	0.000	69.884	57
NHL	0.037	0.339	0.339	0.193	0.339	0.000	73.172	56
Overall	0.182	0.511	0.396	0.278	0.396	0.278	64.833	227

The intervention profiles reveal distinctive approaches to competitive balance across leagues. The NFL has maintained the highest level of revenue sharing (40%) throughout the study period, reflecting its strong commitment to financial equity among franchises. This consistent approach stands in contrast to the other leagues, which implemented revenue sharing later or at lower levels. MLB introduced revenue sharing in 1997 (20%), eventually increasing to 48% by the 2020s. The NBA implemented significant revenue sharing (50%) only beginning in 2011, while the NHL has maintained the lowest revenue sharing percentage (11%) since its implementation in 2005.

Salary caps have been implemented in three of the four leagues, with varying adoption timelines. The NBA was the first to introduce a salary cap in 1983, followed by the NFL in 1993, and the NHL in 2005 after its lockout season. MLB remains the only league without a salary cap,

choosing instead to rely on its luxury tax system. These staggered implementation dates provide valuable variation for assessing intervention effectiveness.

Salary floors have been implemented alongside caps in the NBA, NFL, and NHL, with different percentages of the cap. The NBA initially set its floor at 53% of the cap in 1983, increasing to 90% by the 2020s. Similarly, the NFL's floor rose from 58% in 1993 to nearly 90% in recent years. The NHL's floor started at 54% in 2005, increasing to around 60% in the 2020s. This variation in floor percentages offers insight into how different minimum spending requirements might affect competitive balance.

Luxury tax systems have been employed by only two leagues—MLB (implemented in 2002) and the NBA (alongside its salary cap since 1983). Neither the NFL nor NHL has implemented a luxury tax system, instead relying on hard salary caps to control spending.

Market size variation, measured by the coefficient of variation of metropolitan statistical area populations, shows substantial differences across leagues. The NHL has the highest variation (73.172), reflecting its mix of large Canadian and U.S. markets alongside smaller markets. MLB shows the lowest market size variation (48.675), despite its reputation for market size disparities. This suggests that perceived market advantages in MLB may stem from factors beyond raw population differences, such as media market characteristics or franchise resource allocation decisions.

Table 4.4: Competitive Balance Measures by Decade (Mean Values)

Decade	CBR	HHI	Gini	PRI	n
1960s	2.09	670.0	0.178	75.0	12
1970s	2.13	523.0	0.173	78.8	40

Decade	CBR	HHI	Gini	PRI	n
1980s	1.98	442.0	0.155	79.6	40
1990s	2.01	395.0	0.156	81.5	40
2000s	1.97	354.0	0.150	81.4	39
2010s	1.95	351.0	0.149	81.1	40
2020s	2.04	348.0	0.154	81.6	16

Figure 4.1: Competitive Balance Ratio by Decade and League (1967-2023)

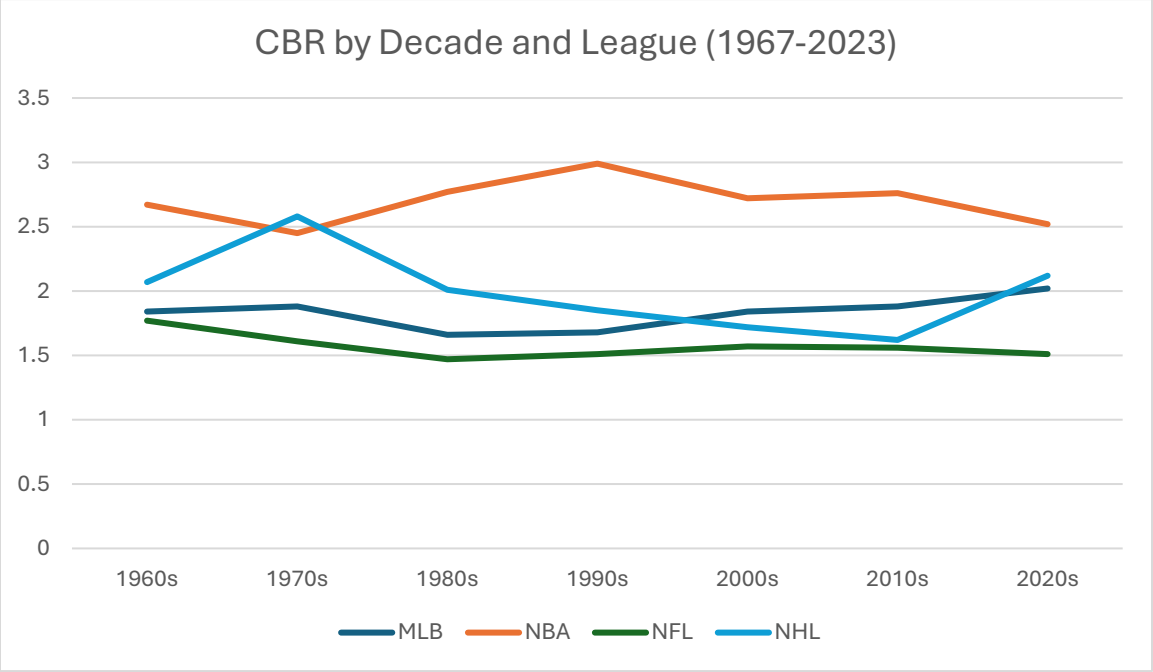

Table 4.5: Intervention Implementation by Decade (Mean Values)

Decade	Rev Sharing	Sal Cap	Sal Floor	Lux Tax	MKT CV	n
1960s	0.100	0.000	0.000	0.000	71.0	12
1970s	0.100	0.000	0.000	0.000	71.0	40

Decade	Rev Sharing	Sal Cap	Sal Floor	Lux Tax	MKT CV	n
1980s	0.100	0.175	0.093	0.175	69.0	40
1990s	0.115	0.425	0.256	0.250	63.3	40
2000s	0.194	0.641	0.438	0.462	60.6	39
2010s	0.352	0.725	0.561	0.500	60.5	40
2020s	0.372	0.750	0.601	0.500	59.3	16

The temporal trends reveal important patterns in competitive balance evolution. The CBR shows initial deterioration from the 1960s (2.09) to the 1970s (2.13), followed by improvement through the 1980s-2010s, reaching its best value in the 2010s (1.95). However, the slight increase in the 2020s (2.04) raises questions about whether the long-term improvement trend might be reversing, though the smaller sample size for this decade (n=16) warrants caution in interpretation.

The HHI shows the most dramatic improvement over time, decreasing from 670.0 in the 1960s to 348.0 in the 2020s. This represents a nearly 50% reduction in win concentration, suggesting substantial progress in distributing victories more evenly across teams. The rate of improvement was most rapid in the early decades, with more modest gains in recent periods.

The Gini coefficient follows a similar pattern of improvement, decreasing from 0.178 in the 1960s to 0.149 in the 2010s, before slightly increasing to 0.154 in the 2020s. This pattern closely mirrors the CBR trend, suggesting consistent signals across different inequality measures.

Playoff repeatability presents an interesting counterpoint, increasing from the 1960s (75.0%) to the 1990s (81.5%) and remaining relatively stable thereafter. This trend suggests somewhat less turnover in playoff participation over time, potentially indicating that while in-season competitive balance has improved, longer-term team success patterns have become slightly more entrenched.

These competitive balance trends coincide with increasing intervention implementation. The early decades (1960s-1970s) saw minimal interventions beyond the NFL's revenue sharing. The 1980s marked the first significant intervention wave with the NBA's salary cap, floor, and luxury tax introduction. Implementation accelerated in the 1990s and 2000s, reaching peak coverage in the 2010s-2020s, with 75% of league-seasons featuring salary caps, 60% with salary floors, 50% with luxury taxes, and revenue sharing reaching its highest levels (37%).

Market size variation has steadily decreased over the study period, from 71.0 in the 1960s to 59.3 in the 2020s. This reduction suggests more balanced market distributions across teams over time, potentially due to franchise relocations to growing metropolitan areas, expansion into new markets, or changes in how teams derive revenue beyond their immediate geographical markets.

Table 4.6: Initial Implementation Year and Value of Interventions by League

Intervention	League	First Year	Initial Value
Revenue Sharing	MLB	1997	0.20
	NBA	2011	0.50
	NFL	1967	0.40
	NHL	2005	0.11

Intervention	League	First Year	Initial Value
Salary Cap	NBA	1983	1.00
	NFL	1993	1.00
	NHL	2005	1.00
Salary Floor	NBA	1983	0.53
	NFL	1993	0.58
	NHL	2005	0.54
Luxury Tax	MLB	2002	1.00
	NBA	1983	1.00

The NFL emerges as an early pioneer in revenue sharing, implementing its 40% sharing system at the beginning of our study period in 1967. This contrasts sharply with the other leagues, which adopted revenue sharing much later: MLB in 1997, NHL in 2005, and NBA last in 2011. When the NBA finally implemented revenue sharing, it did so at the highest initial level (50%), perhaps responding to growing concerns about market disparities affecting league parity.

Salary caps spread across leagues in three distinct phases: the NBA in 1983, the NFL in 1993, and the NHL in 2005. Each league implemented caps at full strength (value of 1.00) rather than phasing them in, representing significant structural shifts in their labor markets. Similarly, salary floors were implemented simultaneously with caps in each league, though at different percentages of the cap (NBA: 53%, NFL: 58%, NHL: 54%).

Luxury tax systems have been limited to the NBA (implemented alongside its cap in 1983) and MLB (adopted in 2002 as an alternative to a salary cap). Both leagues implemented these systems at full strength from inception. The NFL and NHL have chosen not to implement luxury taxes, relying instead on hard salary caps to control team spending.

These implementation patterns provide valuable natural experiment conditions for analyzing the effectiveness of various interventions, with different leagues adopting different mechanisms at different times throughout the study period.

Regression Results

Table 4.7: **Two-Way Fixed Effects Regression Results for Competitive Balance Measures**

Variable	CBR	HHI	Gini	Playoff Repeatability
Revenue Sharing	1.571 (0.870)†	1184.155 (414.632)***	-0.070 (0.078)	184.067 (43.156)***
Salary Cap	7.377 (4.835)	-838.137 (546.065)	0.305 (0.385)	309.990 (70.314)***
Salary Floor	-13.449 (6.744)*	172.819 (850.850)	-0.738 (0.538)	-390.847 (78.251)***
Luxury Tax	0.211 (0.941)	357.319 (35.283)***	0.046 (0.070)	-39.387 (20.178)†
Market Size CV	-0.003 (0.003)	-1.016 (0.501)*	-0.0004 (0.0002)†	0.412 (0.114)***
RS × Market Size	-0.023 (0.011)*	-17.973 (6.517)**	0.001 (0.001)	-2.789 (0.652)***
SC × Market Size	-0.120 (0.075)	10.990 (8.747)	-0.006 (0.006)	-4.658 (1.042)***
SF × Market Size	0.220 (0.104)*	1.377 (13.408)	0.013 (0.008)†	5.885 (1.188)***
LT × Market Size	0.005 (0.015)	-6.476 (0.887)***	0.0001 (0.001)	0.775 (0.349)*
R^2	0.220	0.496	0.323	0.146
Adj. R^2	-0.116	0.279	0.031	-0.232
F-statistic	4.951***	17.261***	8.358***	2.834**
N	227	227	227	216

Variable	CBR	HHI	Gini	Playoff Repeatability
League Fixed Effects				
MLB	1.963	689.11	0.108	31.166
NBA	2.749	845.59	0.192	40.177
NFL	1.890	775.88	0.268	47.577
NHL	2.451	881.77	0.201	47.276

Note: Robust standard errors in parentheses. Significance levels: † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The explanatory power varies considerably across models for different competitive balance measures. The HHI model demonstrates the strongest fit ($R^2 = .496$), indicating that approximately half of the variation in win concentration can be explained by the interventions, market size factors, and fixed effects included in our model. This is supported by a highly significant F-statistic ($F(9, 158) = 17.26$, $p < .001$). In contrast, the playoff repeatability model shows the weakest fit ($R^2 = .146$), with a lower but still significant F-statistic ($F(9, 149) = 2.83$, $p = .004$), suggesting that playoff participation patterns may be influenced by factors beyond those captured in our model. The CBR ($R^2 = .220$, $F(9, 158) = 4.95$, $p < .001$) and Gini coefficient ($R^2 = .323$, $F(9, 158) = 8.36$, $p < .001$) models show intermediate levels of explanatory power. The negative adjusted R^2 values in some models (ranging from -.232 to .279) are a result of the model complexity—specifically the two-way fixed effects specification and numerous interaction terms—relative to the sample size of 227 observations across four leagues. This pattern is not uncommon in panel data models with multiple fixed effects and interactions. Despite these negative adjusted R^2 values, the highly significant F-statistics across all models confirm that our specifications collectively explain a meaningful portion of the variation in competitive balance

measures. The stronger fit for the HHI model may reflect its direct focus on win concentration, which could be more immediately responsive to financial interventions than more complex competitive balance dimensions captured by other measures.

Our regression analysis reveals several important patterns regarding the effectiveness of competitive balance interventions across the four major North American sports leagues:

Salary Floors show a significant negative relationship with CBR ($\beta = -13.449$, $p < 0.05$) and playoff repeatability ($\beta = -390.847$, $p < 0.001$), indicating that higher salary floors are associated with improved competitive balance and increased playoff turnover. However, this effect is moderated by market size variation, as the interaction term between salary floor and market size is significantly positive for both measures.

Revenue Sharing demonstrates complex effects that depend on market size variation. For HHI, revenue sharing shows a strong positive association ($\beta = 1184.155$, $p < 0.001$), suggesting higher revenue sharing is associated with increased concentration of wins. However, the significant negative interaction with market size ($\beta = -17.973$, $p < 0.01$) indicates that revenue sharing improves competitive balance in leagues with greater market size variation.

Luxury Tax shows a significant positive relationship with HHI ($\beta = 357.319$, $p < 0.001$), suggesting it may increase win concentration. This effect is moderated by market size ($\beta = -6.476$, $p < 0.001$), indicating luxury taxes are more effective in reducing win concentration in leagues with higher market size variation.

Market Size Moderation is evident across all competitive balance measures, with nearly all intervention effects significantly moderated by market size variation. This finding highlights

the importance of considering league-specific market characteristics when implementing competitive balance mechanisms.

League Differences persist even after controlling for interventions, as shown by the league fixed effects. The NBA consistently shows the weakest competitive balance with the highest CBR (2.749) and second-highest HHI (845.59), despite implementing all major intervention types. The NFL demonstrates the strongest competitive balance in terms of CBR (1.890), while MLB shows the most equitable win distribution with the lowest HHI (689.11) and Gini coefficient (0.108).

These findings suggest that no single intervention is universally related to competitive balance across all measures. Rather, the effectiveness of each mechanism likely depends on the specific league context, particularly the variation in market sizes among teams.

Chapter Five: Discussion and Conclusion

Research Questions and Results

This study was designed to address the primary research question: Which competitive balance interventions in MLB, NFL, NBA, and NHL have been most effective in improving league parity from 1967 to 2023? Our analysis employed multiple competitive balance measures and two-way fixed effects panel regression models to determine the effectiveness of various interventions across different league contexts.

The findings provide strong support for our primary hypothesis (H1) that different competitive balance interventions have varying impacts on league parity across the four major sports leagues. As predicted by Fort and Quirk (1995), who argued that the effectiveness of cross-subsidization schemes depends on their specific implementation, we found substantial variation in how each intervention affected competitive balance measures. Our findings also confirm the second hypothesis (H2) regarding market size variability, as the effectiveness of interventions was significantly moderated by market size variation across all competitive balance measures. This aligns with El-Hodiri and Quirk's (1971) theoretical predictions about larger market teams' tendency toward dominance and the need for interventions that specifically address market disparities.

The findings reveal complex and sometimes counterintuitive relationships between competitive balance interventions and their outcomes. Salary floors emerged as the most consistently effective mechanism for improving competitive balance, showing a significant negative relationship with CBR ($\beta = -13.449$, $p < 0.05$) and playoff repeatability ($\beta = -390.847$, $p < 0.001$). This suggests that establishing minimum team spending thresholds helps reduce

disparities between teams and increases playoff turnover. This aligns with theoretical expectations that salary floors prevent extreme cost-cutting strategies and ensure even lower-revenue teams maintain competitive rosters, supporting Rascher's (2011) concern that teams might not reinvest revenue sharing funds without such requirements.

However, the effectiveness of salary floors diminished in leagues with greater market size variation, as indicated by the significant positive interaction terms. This suggests that salary floors alone may be insufficient to address competitive imbalances when market size disparities are substantial. In such contexts, the financial burden of meeting floor requirements may strain smaller-market teams without adequately addressing their competitive disadvantages relative to large-market franchises, echoing Lewis's (2008) findings on the intensified incentive differences created by certain interventions.

Revenue sharing demonstrated notably complex effects, with outcomes heavily dependent on market size contexts. In leagues with relatively uniform market sizes, revenue sharing was associated with decreased competitive balance (increased HHI). However, in leagues with greater market size variation, revenue sharing showed positive effects on competitive balance, as indicated by the significant negative interaction terms. This finding supports Rockerbie's (2020) research on revenue sharing's potential to reduce variance in revenue distribution, while also confirming Maxcy's (2006, 2009) caution that revenue sharing can create problematic incentives for low-revenue clubs in certain contexts.

Luxury tax systems showed mixed effects, generally associated with increased win concentration (higher HHI) but with significant moderation by market size variation. The luxury tax appears more effective in leagues with greater market size disparities, suggesting it may help constrain spending disparities between large and small market teams. This partial effectiveness

aligns with Dietl's (2009) and Ajilore's (2007) findings on luxury taxes' positive influence on competitive balance, while also reflecting Marburger's (1997) concerns about teams finding ways around such systems.

Salary caps alone showed fewer direct significant effects than expected, perhaps due to their high correlation with salary floors in implementation. This finding challenges Fort and Quirk's (1995) assertion that salary caps are the only cross-subsidization scheme that effectively achieves competitive balance. However, caps demonstrated strong negative interaction effects with market size for playoff repeatability, suggesting they may be particularly effective at increasing playoff turnover in leagues with large market disparities, which does support aspects of their theoretical framework.

League-specific patterns revealed persistent differences in competitive balance even after controlling for interventions. The NFL consistently demonstrated the strongest competitive balance in terms of CBR, supporting Einolf's (2004) finding that the NFL's salary cap and revenue sharing system has increased efficiency compared to MLB. MLB showed the most equitable win distribution (lowest HHI and Gini) despite lacking a salary cap, aligning with Zimbalist's (2010) suggestion that MLB's lower salary share in revenue may render a hard cap unnecessary for certain aspects of competitive balance. The NBA exhibited the weakest competitive balance despite implementing all major intervention types, highlighting how league-specific factors like the outsized impact of star players can limit intervention effectiveness, as observed by Hill and Groothuis (2001).

The varying performance of our models across different competitive balance measures warrants further consideration. The HHI model demonstrated the strongest explanatory power ($R^2 = .496$), suggesting that win concentration may be more directly responsive to financial

interventions than other competitive balance dimensions. This aligns with Schmidt and Berri's (2002) observation that the HHI effectively captures the structural aspects of competition that are most immediately affected by financial regulations. In contrast, the weaker performance of the playoff repeatability model ($R^2 = .146$) may reflect Soebbing's (2008) finding that fan response to competitive balance—and by extension, league priorities in structuring playoffs—involves factors beyond simple financial parity. The intermediate performance of the CBR and Gini models ($R^2 = .220$ and .323, respectively) suggests that these measures capture aspects of competitive balance that are partially, but not completely, determined by the financial interventions we studied. As Humphreys (2002) noted in developing the CBR, competitive balance is multidimensional, with some aspects more responsive to policy interventions than others. The stronger relationship between luxury taxes and HHI compared to other measures supports Dietl's (2009) contention that luxury taxes primarily affect resource distribution rather than directly altering on-field outcomes. Similarly, the strong effect of salary floors on CBR aligns with Fort and Quirk's (1995) emphasis on minimum spending requirements as crucial for preventing extreme talent disparities. These varying model performances also reflect Budzinski and Pawlowski's (2014) finding that consumers perceive competitive balance differently across different dimensions of competition, suggesting that different interventions may target different aspects of competitive balance that leagues prioritize. The effectiveness of market size interactions across all measures validates El-Hodiri and Quirk's (1971) foundational work on the fundamental relationship between market size and competitive dynamics in professional sports leagues, suggesting that market context remains one of the most reliable predictors of how interventions will perform regardless of which specific measure of competitive balance is examined.

These findings suggest that no single intervention universally improves competitive balance. Rather, the effectiveness of each mechanism likely depends on the specific league context, particularly the variation in market sizes among teams. This underscores the importance of tailored approaches to competitive balance that consider each league's unique structural characteristics, supporting the theoretical framework established by sports economists such as Rottenberg (1956), El-Hodiri and Quirk (1971), and Szymanski (2003).

Limitations

Despite the comprehensive approach taken in this study, several limitations warrant acknowledgment. First, the use of two-way fixed effects models, while supported by the Hausman test, may not fully capture the complex dynamic relationships between interventions and competitive balance outcomes. The potential endogeneity between competitive balance and intervention implementation presents a challenge, as leagues might implement or strengthen mechanisms in response to perceived imbalances rather than as exogenous policy changes.

Second, the study faced constraints in measuring the precise implementation of interventions. While we captured the presence and basic magnitude of mechanisms like revenue sharing percentages and salary floor ratios, we could not account for all nuances in implementation. For example, the specific structure of luxury tax penalties, revenue sharing formulas, or exceptions to salary caps varies considerably across leagues and over time. These details may significantly influence intervention effectiveness beyond what our models could capture.

Third, our market size measure relied primarily on metropolitan statistical area population, which may not fully reflect a team's economic potential. Modern professional sports teams derive revenue from increasingly diverse sources, including national and international

media rights, digital platforms, and merchandising. These revenue streams may be less directly tied to local market size than traditional gate receipts, potentially reducing the explanatory power of our market size variable.

Fourth, while we examined a substantial time period (1967-2023), the staggered implementation of interventions resulted in limited observation periods for some mechanisms in some leagues. For instance, the NHL's salary cap has only been in place since 2005, and the NBA's substantial revenue sharing since 2011. These relatively short post-implementation periods may limit our ability to detect long-term effects.

Fifth, our models may be affected by omitted variable bias due to non-financial interventions and league-specific rules that impact competitive balance but were not included in our analysis. These include draft systems (lottery vs. reverse-order), playoff format changes, rule modifications that affect gameplay (such as the NBA's three-point line introduction or MLB's designated hitter rule), free agency restrictions, international player recruitment policies, and league expansion or contraction events. As Cavagnac (2009) notes, these non-financial factors can significantly alter the strategic landscape within which teams operate, potentially enhancing or counteracting the effects of the financial interventions we studied.

Sixth, our analysis could not fully account for the sophisticated strategic management practices teams employ to navigate intervention constraints. These include deferred contract structures that shift financial obligations to future years, front-loading or back-loading contracts to optimize salary cap impacts, creative use of injured reserve designations, strategic timing of player acquisitions and releases, and complex trade structures involving future considerations. As Lewis (2007) observed, large-market teams in particular may develop advanced salary cap management strategies that effectively circumvent the intended constraints of competitive

balance interventions. The ability of teams to exploit these strategic options likely varies based on management quality, market resources, and league-specific regulatory environments, potentially creating competitive advantages not captured in our models.

Finally, our focus on the four major North American sports leagues, while allowing for comparative analysis, limits the generalizability of findings to leagues with different structures, such as promotion-relegation systems common in European soccer. The unique historical, cultural, and economic contexts of MLB, NFL, NBA, and NHL shape how interventions function in ways that may not translate to other sporting contexts.

Recommendations for Future Research

Based on our findings and limitations, several promising avenues for future research emerge. First, future studies should explore more sophisticated econometric approaches to address potential endogeneity concerns. Instrumental variable approaches, difference-in-differences designs, or synthetic control methods could provide more robust causal inference about intervention effects. These approaches might better isolate the impact of specific policy changes from broader trends in competitive balance.

Second, researchers should develop more nuanced measures of intervention implementation that capture the specific structures and mechanisms of revenue sharing, salary caps, and luxury taxes. This might include graduated penalty scales for luxury taxes, distributions formulas for revenue sharing, or exceptions allowances for salary caps. Such detailed measurements would provide greater insight into which specific aspects of these interventions drive their effectiveness.

Third, future research should explore alternative conceptualizations of market size that account for modern revenue streams in professional sports. Developing composite indices that incorporate traditional population measures alongside media market size, digital engagement metrics, and international fan base estimates would provide a more comprehensive understanding of a team's economic potential and how it interacts with competitive balance interventions.

Fourth, extending this analysis to include other professional sports leagues, particularly those with different structural features like promotion-relegation systems, would test the generalizability of our findings. Cross-cultural comparisons between North American, European, and Asian professional leagues could illuminate how different sporting traditions and economic contexts shape the effectiveness of competitive balance interventions.

Fifth, qualitative research examining how team decision-makers respond to various interventions would complement quantitative analyses. Interviews with team executives, league officials, and player representatives could provide insight into how interventions shape strategic decisions about player acquisition, development, and retention. This would help explain the mechanisms through which interventions affect competitive outcomes.

Sixth, the Playoff Repeatability Index (PRI) introduced in this study shows promise as a novel measure of competitive balance but requires further refinement to account for structural league differences. Future research should develop normalized versions of the PRI that adjust for the varying playoff qualification thresholds across leagues (ranging from historically less than 30% of teams in MLB to over 50% in the NBA and NHL). This normalized index could incorporate weighted coefficients based on the proportion of teams making the playoffs, expected qualification probability given league size, or even the specific playoff bracket structure. Additionally, researchers might explore dynamic PRI variants that account for changes

in playoff formats over time within the same league. This would allow for more meaningful cross-league comparisons and potentially reveal whether certain intervention types specifically impact long-term competitive mobility rather than single-season parity. Such refinements would enhance the PRI's utility as a complementary measure to traditional within-season competitive balance metrics, addressing Budzinski and Pawlowski's (2014) observation that balance in sub-competitions like championship races may be more important to consumers than overall league balance.

Finally, future research should investigate fan perceptions of competitive balance and how they relate to objective measures. The ultimate goal of competitive balance interventions is to maintain fan interest and league popularity. Understanding how fans perceive and respond to different levels and types of competitive balance would help leagues optimize their intervention strategies to maximize fan engagement.

Conclusion

This study has provided a comprehensive analysis of competitive balance interventions across the four major North American sports leagues from 1967 to 2023. By examining multiple competitive balance measures and employing panel regression models, we have identified complex relationships between interventions and outcomes that depend significantly on league contexts, particularly market size variation.

Revisiting our primary research question—which competitive balance interventions have been most effective in improving league parity—our analysis confirms that effectiveness varies substantially across contexts. Our findings strongly support both research hypotheses. First, different competitive balance interventions indeed have varying impacts on league parity across

the four major sports leagues (H1), with salary floors emerging as the most consistently effective mechanism. Second, market size variability significantly influences intervention effectiveness (H2), with interventions like revenue sharing showing positive effects primarily in leagues with greater market size disparity. These findings advance our understanding of competitive balance by moving beyond simple questions of whether interventions work to more nuanced considerations of when and under what conditions they are most effective.

Our findings suggest that salary floors represent the most consistently effective intervention for improving competitive balance, while revenue sharing and luxury taxes show effectiveness primarily in leagues with substantial market size disparities. The persistent differences in competitive balance across leagues, even after controlling for interventions, highlight the importance of league-specific characteristics in shaping parity outcomes.

These results have significant implications for league policy. They suggest that one-size-fits-all approaches to competitive balance are unlikely to succeed. Instead, leagues should tailor interventions to their specific economic structures and competitive dynamics. For leagues with substantial market size disparities, combinations of revenue sharing and salary floors may prove most effective. Leagues with more uniform market sizes might focus more on ensuring robust salary floors without extensive revenue redistribution that could distort incentives.

The evolution of competitive balance over our study period shows general improvement on most measures, coinciding with increased intervention implementation. This suggests that collective bargaining agreements and league policies have generally moved in productive directions. However, the slight reversal in some competitive balance trends in the 2020s raises questions about whether current intervention levels remain optimal as sports economics continue to evolve in the digital era.

As professional sports continue to grow in economic significance and global reach, maintaining competitive balance remains crucial for their long-term health and popularity. This study contributes to understanding which interventions work best in which contexts, providing an empirical foundation for future policy decisions. By continuing to refine and adapt competitive balance mechanisms, sports leagues can ensure they deliver the compelling, unpredictable competition that fans cherish while maintaining the economic viability that sustains the professional sports enterprise.

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Appendix

R Code from Panel Regression

```
# Load Required Libraries
library(plm)
library(lmtest)
library(sandwich)
library(stargazer)

# Read the data
data <- read.csv("league_winpct_sd.csv")

# Convert categorical variables to factors
data$league <- as.factor(data$league)
data$Season <- as.numeric(data$Season)

# Create interaction terms
data$RS_MKT <- data$RS * data$cv_value
data$SC_MKT <- data$SC * data$cv_value
data$SF_MKT <- data$SF * data$cv_value
data$LT_MKT <- data$LT * data$cv_value

# Convert data to panel data format
panel_data <- pdata.frame(data, index = c("league", "Season"))

# ================================================
# 1. CBR Model: Two-Way Fixed Effects
# ================================================
```

```
cbr_model <- plm(CBR ~ RS + SC + SF + LT + cv_value + RS_MKT + SC_MKT + SF_MKT +
LT_MKT,
                 data = panel_data,
                 model = "within",
                 effect = "twoways")

print(summary(cbr_model))

# Extract fixed effects
cbr_league_fe <- fixef(cbr_model, effect = "individual")
cbr_time_fe <- fixef(cbr_model, effect = "time")

print(cbr_league_fe)

# ================================================
# 2. HHI Model: Two-Way Fixed Effects
# ================================================

hhi_model <- plm(HHI ~ RS + SC + SF + LT + cv_value + RS_MKT + SC_MKT + SF_MKT +
LT_MKT,
                 data = panel_data,
                 model = "within",
                 effect = "twoways")

print(summary(hhi_model))

# Extract fixed effects
hhi_league_fe <- fixef(hhi_model, effect = "individual")
hhi_time_fe <- fixef(hhi_model, effect = "time")
```

```
print(hhi_league_fe)

# ======================================================
# 3. Gini Model: Two-Way Fixed Effects
# ======================================================

gini_model <- plm(Gini ~ RS + SC + SF + LT + cv_value + RS_MKT + SC_MKT + SF_MKT +
LT_MKT,
                  data = panel_data,
                  model = "within",
                  effect = "twoways")

print(summary(gini_model))

# Extract fixed effects
gini_league_fe <- fixef(gini_model, effect = "individual")
gini_time_fe <- fixef(gini_model, effect = "time")

print(gini_league_fe)

# ======================================================
# 4. Repeatability Model: Two-Way Fixed Effects
# ======================================================

repeat_model <- plm(repeatability ~ RS + SC + SF + LT + cv_value + RS_MKT + SC_MKT +
SF_MKT + LT_MKT,
                    data = panel_data,
                    model = "within",
                    effect = "twoways")
```

```
print(summary(repeat_model))

# Extract fixed effects
repeat_league_fe <- fixef(repeat_model, effect = "individual")
repeat_time_fe <- fixef(repeat_model, effect = "time")

print(repeat_league_fe)

# Create results table with all four variables
stargazer(cbr_model, hhi_model, gini_model, repeat_model,
          title = "Competitive Balance Two-Way Fixed Effects Regression Results",
          column.labels = c("CBR", "HHI", "Gini", "Repeatability"),
          model.names = FALSE,
          type = "text",
          digits = 3,
          omit.stat = c("ser", "f"),
          notes = "Standard errors in parentheses.")
```