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Does salary dispersion affect team performance in cricket? Evidence from the Indian Premier League

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Abstract

This study examines the relationship between salary dispersion and team performance in cricket, using the Indian Premier League (IPL) data from 2008 – 2019. We employ a dynamic panel regression to test the applicability of the Equity theory and the Tournament theory in explaining team performance. Our results show that higher salary dispersion positively affects team performance, supporting the tournament theory. The study also highlights the effect of relative and overall spending by teams on their performance. The findings could be used for managing players and teams better apart from fine-tuning the strategies during player bidding. This study contributes to the sports management literature by being among the first studies to explore the impact of salary dispersion on team performance in Twenty20 cricket.

Keywords: Tournament theory, Equity theory, Twenty20 cricket, Indian Premier League, Dynamic panel estimation

1. Introduction

Professional sports have been a testing ground for economic theories as the compensation of the players selected for a team varies widely (Sacheti et al., 2016). There is a significant disparity in pay among players, as shown in Berri & Simmons (2009), who analyzed the difference in compensations in the National Football League. Some teams compensate their players almost on similar pay bands, while other teams invest substantial amounts of money on a small group of high-performance players, also known as superstars. The organizational theory literature has shown that intra-organization salary disparity may cripple group harmony by creating a perception of inequality and jealousy among employees(Kabanoff, 1991). If so, such a phenomenon in team sports such as cricket may also result in a dip in the players' motivation leading to reduced performance. Both the team-cohesiveness hypothesis (Levine, 1991) and the equity pay theory (Lazear, 1989) argue that narrow dispersion in salaries reduces dissonance among team members, resulting in the team members' improved performance.

In contrast, the Tournament theory (Lazear & Rosen, 1981) suggests that a higher salary disparity across different positions motivates employees to put higher effort levels. Therefore, the tournament theory predicts that greater salary dispersion positively affects group performance. Given an upper limit to payroll budgets, salary dispersion is an important cahallenge, yet it is unclear which of the abovementioned salary structures leads to better performance. In this paper, we study the salary dispersion-team performance relationship in the context of Twenty20 cricket.

The motivation theories might act differently for different sports; for instance, soccer requires high coordination and cohesion among the players for better performance, and matches

cannot be won by relying on the performances of a few highly skilled players (Franck & Nüesch, 2011). Bose et al. (2010) and Harder (1992) find that within a team, underpaid players could "sabotage" team performance and play more selfishly, resulting in lower team performance. Such contradictory predictions have led to a growth in the empirical literature on salary disparity and team performance. In the past, various studies have been conducted to analyze Basketball, Baseball, Hockey, Rugby, and Soccer, among others which have provided mixed evidence. Very few studies support the tournament theory, i.e. find evidence that a more differentiated salary structure produces positive effects on team performance (Marchand et al., 2006). On the other hand, a majority of studies support the equity pay theory for a team's on-field performance (Bloom, 1999; Depken, 2000; Mondello & Maxcy, 2009; Tao et al., 2016; Wiseman et al., 2003). Some studies do not find significant evidence to support either theory (Avrutin & Sommers, 2007; Katayama & Nuch, 2011), while a few papers provide mixed evidence (Frick et al., 2003).

Cricket is a unique team sport. It requires a highly individual-centric performance as well as significant team-effort to win a game. Sometimes a single player has a profound impact on the match outcome e.g. in the late 1990s and early 2000s Sachin Tendulkar was considered as a superstar due to his ability to win many matches with individual performances. On the other hand, there are cases where team effort was essential in winning the match e.g. there are three instances when player of the match award was shared with all players due to no individual standout performance[1]. Hence, it becomes interesting to investigate the underlying motivation for team performance in cricket.

[1] https://www.sportskeeda.com/cricket/3-times-the-entire-team-received-the-man-of-the-match-award

Although several sports have been studied to various extents, very few papers have studied cricket. Cricket is one of the most popular games in Australia, England, India, Pakistan, Bangladesh, Sri Lanka, and New Zealand, among others. It originated from England and spread worldwide with the British Empire's reign (Sur & Sasaki, 2020). The International Cricket Council (ICC) has identified a total of 104 countries as cricket-playing nations[2]. Cricket has evolved through various stages starting from five-day test matches to limited-overs games, including 50 overs and more recently 20 overs for each side. Twenty20 appeared like a revolution in cricket, which led to explosive growth in demand (Lenten et al., 2012). The advantage of Twenty20 cricket is that it is played for three to four hours that is suitable for modern day television audiences who seek shorter duration entertainment (Sur & Sasaki, 2020). Though the number of participating countries in cricket is few compared to other sports like soccer, these countries constitute a significant percentage of the population worldwide, making this study highly relevant.

In 2007, the first Twenty20 (T20) World Cup was organized, which brought immense popularity to this format (Rumford, 2011). It was followed by the Indian Premier League (IPL) in 2008 conducted by the BCCI (Board of Cricket Control of India). IPL had a mix of International, Domestic and Uncapped cricket players. It proved to be hugely popular, leading to many players getting fame and earning a place in their respective national teams. IPL has seen an ever-growing fan base for eight teams that, usually representing eight cities in India, compete with each other. As per the US-based consultancy firm Duff & Phelps, the brand value of IPL in 2018 was US$ 6.3 billion[3], which is set to grow further considering the growing fan base around

[2] International Cricket Council (icc-cricket.com)
[3] https://www.duffandphelps.com/insights/publications/valuation/ipl-brand-valuation-report-2018. Retrieved March 29, 2021.

the world. BARC India viewership data states that over 462 million viewers watched the 12th edition of the IPL on Star Network, the official broadcaster for the 2019 season[4]. Additionally, a prize of 200 million INR[5] for the winning team makes IPL one of the major tournaments across the globe. The title sponsorship of IPL started with 500 million INR during 2008 to 2012 and went up to 4.4 billion INR for the seasons between 2017 and 2022[6].

IPL conducts player auctions in which the winning bid determines the player's annual wage for a particular number of seasons. The bidding process has generated significant variations in the salary of the players. Bidding allows the team owners to compete for any specific player, leading to bidding wars which sometimes fetches huge salaries for a few famous players. For instance, after a successful T20 World Cup 2007, the then captain of the Indian T20 team MS Dhoni grabbed an INR 60 million worth annual contract from the team Chennai Super Kings in the inaugural season of IPL. The subsequent seasons witnessed higher bid amounts for the players who performed well in T20s, both at the International level and in their respective domestic circuits. In 2015, Delhi Daredevils spent INR 160 million to get a top-rated player, Yuvraj Singh, in their squad. Such significant spending on a single 'superstar' forced the team management to settle for low-budget players to form the remaining team, creating a significant disparity in the players' salary. This strategy appeared to rapidly spread across the teams, as it has been often seen that such superstar players can win matches single-handedly for their sides.

Apart from cricket, sports such as basketball has witnessed players like Michael Jordan and LeBron James single-handedly leading their teams to victory on multiple occasions. From a

[4] IPL - Over the Years.pdf. (2020). Retrieved January 22, 2020, from https://www.barcindia.co.in/resources/IPL%20-%20Over%20the%20Years.pdf
[5] 1 USD = 73.50 INR (Indian Rupee) as on 29th March 2021.
[6] https://www.duffandphelps.com/-/media/assets/pdfs/news/valuation-services/ipl-the-decade-edition-1.ashx?la=en&hash=753A96324F700D812D5273F9CEF40C084FC5BBC9

marketing perspective, these superstars also play a crucial role in pulling crowds to fill up stadiums, which is of interest to all team owners. Such an impact created by these highly skilled players prompts team managements to acquire them by paying them a much higher amount compared to the rest of the team, which generates considerable variation in player salaries within teams. While superstars might be glamorous and beneficial for the team in a few cases, this strategy often backfires when a balanced team is needed. The soccer teams of Argentina and Portugal boasts of some of the world's best players, such as Lionel Messi and Cristiano Ronaldo, but the teams do not feature in the FIFA World Cup winners list.

The role of a superstar differs depending on the sport and team effort is frequently required to win the game. Several questions have been asked to justify spending the lion's share, causing inequity in the team. This paper attempts to contribute to the sport management literature by examining the relationship between salary dispersion and team performance in the context of cricket. We present an empirical analysis of salary dispersion and team performance in T20 cricket using IPL data from 2008 to 2019. Our provide evidence for the role of “superstars” in T20 cricket i.e. higher salary dispersion is related to better team performance, thereby supporting the tournament theory. These findings have essential insights for sport managers, specifically in selecting and bidding for players, which we explain as part of the discussion later on.

The rest of the paper is organized as follows: Section 2 provides a brief discussion of the theoretical background of the study. Section 3 explains the data and methodology used, while section 4 describes the results obtained from the dynamic panel regression analysis. Section 5 concludes the paper with managerial implications, limitations, and future directions for research.

2. Theoretical Background

This study contributes to the stream of literature in sports management and sports economics investigating the relationship between salary dispersion and team performance, with our unique focus being on T20 cricket. As there are similar studies for different sports like Basketball, Baseball, Hockey, Rugby, and Football, we refer to these studies to develop the theoretical background.

We performed a literature review using the following keyword search string in the Title, Abstract, and Keywords section of documents using the SCOPUS database –

(sport* OR football OR baseball OR hockey OR soccer OR cricket OR basketball)
("equity theory" OR "tournament theory" OR "team cohesiveness hypothesis" OR "relative deprivation theory" OR superstar* OR "Team performance" OR "team cohesion" OR "labor shirking" OR production OR success OR "win percentage" OR "winning percentage").
We included articles in the English language, sourced from Journals. The studies based on individual-level sports were excluded, and only the team-level sport based studies were considered. We filtered the articles after reading the titles and abstracts of the above-obtained studies, leading to a final selection of 35 papers.

We found that the existing literature has investigated salary dispersion and team performance in different sports. The game of cricket has been investigated for different phenomena in the context of five-day tests, One Day games, and other International matches. However, the effect of salary dispersion on performance in T20 cricket has not been explored to

the best of our knowledge. A brief overview of the current state of literature in the above two streams is provided below.

2.1 Salary disparity and performance in sports

Salary disparity has been studied by various authors, starting as early as Adams (1963)'s equity approach and the consequent psychological impact on worker behaviour. The literature on salary disparity can be broadly divided into two categories, as described by the two contradicting theories: equity theory and tournament theory. The equity viewpoint was shown by Akerlof & Yellen (1990), Lazear (1989), and Levine (1991). These studies suggest that unequal wages might encourage workers to engage in nonproductive work and look for unethical means to get a higher salary. On the contrary, the tournament model developed by Lazear & Rosen (1981) suggests higher wage difference as a way to increase productivity. It says that employees are unequal in their abilities to sabotage the firm and therefore should be paid accordingly. This hierarchy creates a disparity in salary and leads to higher productivity (Ramaswamy & Rowthorn, 1991). To support either of these theories, a limited amount of work has been done in the organizational context (Dole, 2015), which may be due to two reasons. First, the availability of salary data is deemed confidential in most organizations. The second reason is the use of subjective measures of performance in different organizations. Professional sports effectively tackle the two limitations of data availability and subjective performance measurement. The data relating to sports is evident and widely published, and performance measures are purely quantitative. This ease of access has resulted in a significant amount of work done in salary disparity and performance analysis across different sports. A summary of relevant existing literature on various sports with details of the performance measure, the theory supported, and the estimation method used is given in Table 1.

Table 1 near here

Table 1 shows that Gini coefficient – originally a measure of economic inequality – is the popularly used measure for salary dispersion in the extant literature. The performance measure has mainly been the win percentage (WP) - the team's percentage wins in the current season. Individual-centric games such as basketball have shown support for the tournament theory, while most sports requiring better cohesion and team effort (such as baseball) have primarily supported the equity theory. A significant number of studies have been conducted in baseball, which might be due to its popularity in the US, where most of the research was conducted. Most of the studies in baseball have also shown support for the equity theory, which might be due to fact that baseball requires greater degree of team effort to win. The studies that supported the tournament theory were mostly from individual-centric games like basketball. The most common methodology used to study the salary dispersion – team performance relationship has been the ordinary least squares (OLS) regression method, which might not be the best method considering the endogeneity of the salaries, as shown by Jane (2010) and Jane et al. (2009). The endogeneity problem introduces bias in the estimation rendering the results unreliable. A few studies like Katayama & Nuch (2011) and Tao et al. (2016) have addressed the issue of endogeneity with Generalized Method of Moments (GMM) method, which has been used in this study.

The steady flow of research papers analyzing the role of salary equity in professional games highlights its importance in the management and economics literature. The literature has grown from individual-level analysis (Harder, 1992; Lord & Hohenfeld, 1979; Neugart & Richiardi, 2013) to team-level analysis (Caruso et al., 2016; Gasparetto & Barajas, 2018; Killins, 2017) in different sports, but the main focus has been on baseball and soccer. With the

advancement of the internet era and ease of data availability, a larger number of studies were published in recent times, as evident from Table 1. Nonetheless, cricket has not been hitherto studied with regards to tournament and equity theory.

2.2 Cricket and the Indian Premier League (IPL)

Although IPL is still in the nascent stage compared to other leagues worldwide, considerable work can be found in the literature. We focus here on studies related to performance analysis and team selection. Lewis (2008) assessed several One Day International (ODI) matches to find evidence of player ranking and players' long-term viability. In the context of IPL, Bayesian classification was used to rate the performance of all-rounders playing in IPL (Saikia & Bhattacharjee, 2011). Karnik (2010) and Lenten et al. (2012) propose a hedonic model for player wage determination in IPL, while Rastogi & Deodhar (2009) explained the relationship between different attributes and the valuation of players in the IPL's inaugural season. Amin & Sharma (2014) performed data envelopment analysis to combine several factors to provide a single score for player performance which can be used to select the best player.

Saikia et al. (2016) attempted to provide a model that can collapse different metrics into a single score in order to ease the selector's job. Rana & Bagchi (2020) performed a survey to gauge the effect of IPL on test cricket in India. Although these studies were focused on the valuation of players and performance analysis of players in the IPL, none of them studied the relation between these two factors, leaving a critical gap in the sports management literature.

3. Data and Methodology

3.1 Data

IPL performance records and players' salary data are published widely in the media and on cricket websites after the players' auction for a particular season is conducted. Our sample data covers the IPL seasons held during the years 2008 - 2019. The number of participating teams has varied over the years, as detailed in Table 2.

Table 2 near here

Data related to the teams' performances in terms of team win percentage and players' salary data were collected from the official website of IPL T20[7] and the InsideSport Moneyball database[8], respectively. The players' salary values were corroborated with the live videos of IPL auctions, newspaper reports, and official team websites. Salary dispersion among teams was measured by calculating the Gini coefficient of player salaries for the respective teams. The descriptive statistics of year-wise total salary, team win percentage, and Gini coefficients are given in Table 3. The mean win percentage is lower than 50% as some matches have been abandoned or washed out in every IPL season.

Table 3 near here

The mean salary appears to have grown threefold over the seasons. It increased from INR 235 million in 2008 to INR 761 million in 2019. The growth in the popularity of the IPL and the

[7] *IPLT20.com—Indian Premier League Official Website. (2020). Retrieved June 7, 2020, from https://www.iplt20.com/*

[8] MoneyBall – The Wage Calculator of Indian Professional leagues. (2020). Retrieved June 7, 2020, from https://moneyball.insidesport.co/ipl-index.php

resulting growth in media revenue combined with inflation might have led to this increase in the mean salary. On the other hand, the mean Gini coefficient has reduced from a value of 0.622 in 2008 to 0.556 in 2019, which implies that the salaries have been paid more evenly within teams in the recent seasons of the IPL. A possible reason may be the increase in the total budget of teams and the rising base price of players in the IPL auctions over the years, which may have reduced the salary dispersion.

The teams with the top ten Gini coefficient values with corresponding season win percentages are detailed in Table 4. We can observe that there is no clear relationship between team performance and salary dispersion, as the win percentages have varied widely from 23.10 % to 62.50 %.

Table 4 near here

To illustrate the potential association between salary dispersion and team performance, we observe the win percentages of two popular teams as shown in Figure 1. We can see that Mumbai Indians have performed better than Royal Challengers Bangalore in most seasons. Still, their team Gini coefficient values have been comparable, as shown in Figure 2. This graph suggests the lack of any apparent relation between salary dispersion and team performance. However in the next session we formally test whether there is a statistical relation between the two variables.

Figure 1 near here

Figure 2 near here

3.2 Empirical methodology

The following equation is used to analyze team performance and its determinants:

$$WinPercentage_{jt} = \Upsilon_0 + \Upsilon_1 * WinPercentage_{jt-1} + \Upsilon_2 * Dispersion_{jt} + \Upsilon_3 * Payroll_{jt} + \beta * Year_t + \Upsilon_4 * CaptainChange_{jt} + \Upsilon_5 * CoachChange_{jt} + \Upsilon_6 * Captain\_Indian_{jt} + \Upsilon_7 * ActivePlayers_{jt} + \Upsilon_j + \varepsilon_{jt} \quad (1)$$

$WinPercentage_{jt}$ is the team performance, $Dispersion_{jt}$ measures the intra-team salary disparity, while $Payroll_{jt}$ stands for the payroll expenditure. $Year_t$ denotes the time trend, which was introduced to control the payroll trend (Depken, 2000) resulting from the growing popularity of IPL, media revenues, and inflation. Υj denotes unobserved individual team heterogeneity, and ε_{jt} represents an error term. The random-effects model is first estimated without including the lagged dependent variable, as suggested by the Hausman test. This model, however, assumes that explanatory variables are strictly exogenous, which is violated if better team performance in the current year leads to higher or lower salary dispersion in the next year. When a team plays well in a given season, the team management might increase the payroll of well-performing players. In case a team performs poorly, team owners may attempt to secure good players from other teams by offering higher salaries. These incidents point to potential endogeneity in the relationship between performance and salary dispersion, leading to inconsistent fixed or random effects estimators. Such endogeneity has been corrected in the related literature using the Generalized Method of Moments (GMM) estimation (Katayama & Nuch, 2011; Tao et al., 2016).

Accordingly we employ the GMM methodology to estimate equation (1), by including a lagged dependent variable as one of the determinants. Other control variables include a dummy variable for the change in captain from the previous season ($CaptainChange_{jt}$), a dummy variable for the change in head coach from the previous season ($CoachChange_{jt}$), a dummy variable for the presence of an Indian captain ($Captain\_Indian_{jt}$), and the number of active players ($ActivePlayers_{jt}$, which corresponds to the number of players who participated for the team in a particular season). Change in captain and coach is expected to be negatively correlated with win percentage as captains and coaches when shown more faith will gain confidence and perform better. A new leadership may need time to generate changes in player behaviour and induce certain mindset of playing according to their style (Holmes, 2011). Some teams like Chennai Super Kings have not changed their captain, while teams like Delhi Capitals have frequently done so, and Chennai Super Kings has been much more successful than Delhi Capitals. An Indian captain in IPL may have better capability in scouting for domestic players than captains from other countries, as Indian captains are more familiar with the domestic pool of cricket players from which most of the players are chosen[9]. Also, Indian captains are better aware of the playing and pitch conditions as they have lived and played in India for most of their domestic and international career.

Similarly, a few teams have remained committed to their coaches. This commitment is likely to help team performance as frequent coach changes (and possibly coaching staff concommitantly) might hinder team building. Active players indicate the number of players from the team roster who have been in the playing team for a minimum of one match for that particular season. Teams have typically large roster sizes and few active players in the IPL. The

[9] https://www.espncricinfo.com/story/arun-venugopal-and-gaurav-sundaraman-how-teams-prepare-for-the-ipl-auction-1083327

number of active players is a relative indicator of a team's consistency, i.e., the lower the number, the higher is the team consistency as there are fewer changes in the squad. It might also indicate better fitness levels of the players (Adhikari et al., 2020). A higher team consistency might boost players' confidence, enabling better performance, as has been seen multiple times in the case of teams such as Chennai Super Kings and Royal Challengers Bangalore[10].

As shown in Table 1, various studies have used the winning percentage of the team in a given season to measure team performance. The equity pay theory suggests that individual players are discouraged by large wage dispersions due to feelings of inequity, and so a negative coefficient for salary dispersion is expected in equation (1). In contrast, the tournament theory implies that individual players are motivated by large wage dispersion, leading to improved team performance. Therefore a positive coefficient for salary dispersion in equation (1) is expected to support the tournament theory.

We use the Gini coefficient to measure the intra-team salary disparity for all teams for all years, considering all players. The Gini coefficient's value varies from 0 to 1, with the value 0 representing the lowest possible dispersion in salary distribution, and 1 illustrates the highest possible salary dispersion. While a majority of the articles have used the Gini coefficient to measure salary dispersion, there is a general lack of consensus on the nature of the payroll variable to be used. Some studies have considered total payroll expense of the team at an absolute level (Bloom, 1999; Frick et al., 2003; Jane, 2010; Richards & Guell, 1998), while others have used logarithmic transformations of the payroll variable due to data normality concerns (Katayama & Nuch, 2011). The payroll variable was excluded in some cases

[10] https://www.cricbuzz.com/cricket-news/112760/why-csk-win-and-rcb-lose-chennai-super-kings-royal-challengers-bangalore-ipl-2020-indian-premier-league-virat-kohli-ms-dhoni-cricbuzzcom

(Marchand et al., 2006). A few studies have considered the relative position of a team's payroll in each season compared to other teams (Tao et al., 2016). Other studies have examined the relative total salary ratio, measured by the percent of total team payroll to league total salary for a particular season (Jane et al., 2009).

We consider the logarithmic transformation of team payroll in absolute levels (log(TotalSalary)) and also the team proportional payroll (ProportionofTotalSalary) to estimate alternative specifications of equation (1). The team proportional payroll is defined as the ratio of a team's total salary for a given year to all teams' total salary for that year, which serves as a measure of inter-team payroll disparity. The coefficients for both ' log(TotalSalary)' and 'ProportionofTotalSalary' are expected to be positive in the model estimation results. Teams with higher values for these variables are more capable of recruiting better players to improve team performance. The definition and measurement of the variables used in this study are detailed in Table 5.

Table 5 near here

We use the GMM method (Arellano–Bover/ Blundell–Bond) of linear dynamic panel-data estimation considering robust standard estimators. As prior season performance (lagged dependent variable) controls for serial dependence (Bloom, 1999), a positive coefficient is expected for this variable, even though its coefficient is not of interest in this study. Bond (2002) proposes that allowing for a dynamic relationship might be critical for recovering consistent estimates of other parameters. The GMM estimator originally followed Anderson & Hsiao (1981)'s framework to remove an unobserved individual-level effect through the first differencing approach. Subsequently, the method proposed by Arellano & Bond (1991)

improved the model by using higher lagged values of the dependent variable as instruments. Arellano & Bover (1995) extended the GMM framework to include additional instruments based on the original equations in levels, which can accommodate predetermined variables. Blundell & Bond (2000) further improved the weak instrument by using lagged differences of the dependent variable as additional instruments for the equation in levels. Therefore, we present the estimates obtained by using the GMM method[11] to supplement the random effects estimation.

4. Results

The estimation results for equation (1) with the payroll variable in absolute level ($\log(TotalSalary)_{jt}$) and proportional level ($ProportionofTotalSalary_{jt}$) are reported in Tables 6 and 7, respectively. The salary dispersion variable ($Dispersion_{jt}$) and the control variables were included in combination with the above-mentioned payroll variables.

Table 6 near here

Table 7 near here

The Sargan test is usually employed for testing the validity of over-identifying restrictions in GMM estimation. However, the Sargan statistics are not available with robust standard error estimates.[12] Instead, for assessing the validity of our estimates, we report the Arellano-Bond test results for zero autocorrelation in first-differenced errors in Tables 6 and 7. It

[11] "xtdpdsys" command using vce(robust) for standard errors in STATA 15.0*

[12] Because its asymptotic distribution is not known under the assumptions of the model with robust standard errors, the "xtdpdsys" command of STATA does not compute the Sargan test. It may also be noted that Arellano & Bond (1991) showed that the one-step Sargan test tends to over reject the null hypothesis in the presence of heteroskedasticity, thereby limiting its usefulness.

implies autocorrelation at order 1, as the null hypothesis (of no autocorrelation) is rejected at the 10% level of significance, which is expected due to the lagged dependent term. At order 2, autocorrelation is absent, which implies that the GMM estimates are consistent.

The results show that the coefficients of $Dispersion_{jt}$ are positive and significant in the GMM estimation (but not in the random effects estimation) in both the specifications, as shown in Table 6 and Table 7. In other words, higher disparity in pay is associated with better performance of teams in the IPL, thereby supporting the tournament theory. The results are similar to those obtained by Avrutin & Sommers (2007), Bloom (1999), Frick et al. (2003), and Marchand et al. (2006). Two possible explanations could be given to support these findings. First, the straightforward measurement and low-performance monitoring cost allow individual performances to be observable, motivating the players to perform well. Second, although a win is attributed to the team, individual performances get significant attention from both the spectators and the selectors at all levels. The players have an opportunity to build up their performance reputation ahead of their subsequent contract renegotiation. Cricketers like Shaun Marsh, Glenn Maxwell, Shreyas Iyer, Kieron Pollard, among others, have gained popularity based on their IPL performances and later did well in international cricket. So the perception of inequality from intra-team disparity might not affect team performance. Rather, the promise of better pay induces the players to raise their effort level.

Also, large salary dispersions might result from a few superstar players with significantly higher salaries compared to the rest of the team members. This type of team is more likely to win an IPL match as the T20 format is fast-paced, and a few players performing well could be sufficient to win the game for their team. Another possibility for higher salary dispersions may be the presence of uncapped, low-paid players. Being given a rare opportunity at the big stage,

these players are much more motivated to perform. Also, well-paid players with good leadership abilities, excellent technical skills, and more experience can lead a team of inexperienced, low-salary players to win matches.

Next, the coefficient of the proportion of the total salary is significant in the GMM estimation (but insignificant in the random effects etimation), which implies that relative payroll spending for different teams is a good indicator of team performance. The negative value of the coefficient of 'ProportionofTotalSalary' indicates that teams with lower relative spending have performed better than their counterparts, which implies that higher spending does not guarantee better performance. Several instances have been observed wherein teams with low salary expenditure have outperformed big-spending high-profile teams. Across all IPL seasons, Royal Challengers Bangalore has been among the topmost relative spenders, while the Rajasthan Royals have been among the lowest. However, Rajasthan Royals has a better overall performance record, including a season win in IPL 2008. A possible explanation might be that the higher paid teams are under more pressure to perform than the others, leading to sub-par performances (Baumeister & Showers, 1986). The total salary variable was insignificant, which indicates that teams' relative spending is more detrimental to team percentage than the total payroll. Further, change in captainship showed a significant relationship to win percentage, indicating the negative effect of leadership change on team performance. Frequent leadership changes bring instability to the team and make captains unsure about their position, affecting the captain and the team's performance.

Among the control variables, only the Captain_Indian dummy and ActivePlayers variable were statistically significant in the random effects model but not significant in the GMM estimation. The positive coefficient of Captain_Indian may suggest that having an Indian captain

helps the teams to perform better while the negative coefficient of ActivePlayers is a puzzle as it indicates that team stability has a negative effect on performance. However, both these variables are not significant in the GMM estimation. The other control variables were statistically insignifiant in both sets of estimations. Several combinations of control variables were tried to check the robustness of our findings and the results were qualitatively similar. For example, year dummies were used instead of the year variable, but most of the dummies turned out to be insignificant, while the main results did not change.[13]

5. Conclusion

The findings of our analysis provide support for the tournament theory in T20 cricket in the context of the IPL, which indicates that a greater disparity in earning of players positively affects the team's performance. The disparity caused due to high salary of superstar players might have a positive effect due to the higher skill set and experience they bring to a team. The value they bring might motivate more than the salary for rest of the players. Also, superstar players could always be counted on to perform in challenging situations, attract crowds, increase viewership, and increase brand revenues. However, exuberant spending on a star-studded may not guarantee improved team performance, as observed by the negative coefficient for the "relative spending" variable. Often it is seen that teams indulge in bidding wars and end up spending much higher amounts than anticipated, so teams should be cautious about over-spending.

Our results are in contrast with studies for various other sports which supported the equity theory (e.g. Annala & Winfree, 2011). The team management could fix the salary

[13] These robustness checks were not reported to save space but are available on request.

structure of crickets in IPL, as suggested by the tournament theory, which motivates players to perform well under senior and skilled players' experience. Heyman (2005) demonstrated the positive effect of salary dispersion on executives' performance in an organizational context. Similarly, this study's implications could be extended to all organizations or roles in which performance is individual-centric rather than being dependent on teamwork.

Several other managerial insights can be derived from our findings. The results in support of the tournament theory suggest that superstar players may motivate a team better than higher player compensation. The presence of one or two superstars might be beneficial for the team, as players are encouraged to perform in the company of their role models and hence would put in their best efforts.

Moreover, higher spending may not guarantee better performance. It has been seen that teams with lower spending have better win percentages. This observation implies that prudent spending and careful selection of a few players is a better strategy than hiring multiple high bid value players. Another important implication is that the consistency of captainship has to be maintained for better performance. A frequent change of the team captain might lead to unrest and hence affects team performance.

Our study is not free from certain limitations. Since the data collected is from T20 matches in IPL, the results might not be generalizable to cricket as the T20 setting differs from One Day and Test matches where more significant team effort is required. Future studies could test the theories in the context of One day and Test matches. Although the data provides empirical evidence for the hypothesized effects, it cannot ensure a causal relationship. Since the IPL commenced in the year 2008, limited data is available for robust measurement.

Finally, the salary paid by a franchise at the players' auction might be different from the total earnings of a player as several other incentives like fair play award, most sixes award, orange cap, purple cap, income from promotional appearances, among others, are available in IPL. Hence, future studies can include the same to compute the total earnings by a player. Also, the crowd's size in a match and international players' restrictions in playing eleven and domestic uncapped players may also affect the results, which could not be examined in this study.

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Table 1. The effect of salary dispersion on team performance in various sports

Sport	Author	Performance measure	Estimation method	Theory supported (Equity /Tournament/Neither supported)
Baseball	Richards & Guell, 1998	WP, DT, LC, WC	OLS, Probit	Equity for WP, Neither supported for DT, LC, WC
	Bloom, 1999	WP, FP, HA	OLS	Equity for WP, HA. Tournament for FP
	Depken, 2000	WP.	FE, RE	Equity
	Frick et al., 2003	WP.	FE, RE	Equity
	Wiseman et al., 2003	WP	OLS	Equity
	Jewell & Molina, 2004	WP	SF	Equity
	Debrock et al., 2004	WP, HA	OLS	Equity
		WP, HA	Two-stage method	Neither supported for WP; Equity for HA
	Avrutin & Sommers, 2007	WP	OLS	Tournament
	Jane et al., 2009	WP.	Panel Granger Causality	Both supported
	Jane, 2010	WP.	Panel Granger Causality	Equity
	Annala & Winfree, 2011	WP.	Pooled Regression and FE.	Equity
	Breunig et al., 2014	WP	OLS	Equity
	Tao et al., 2016	WP	RE, GMM	Equity (team payroll as a control variable); Neither supported (team relative payroll as a control variable)
Basketball	Frick et al., 2003	WP.	FE, RE	Tournament
	Berri & Jewell, 2004	ΔWP.	FE, RE	Neither supported
	Katayama & Nuch, 2011	RTP, WP.	FE, GMM	Neither supported
Hockey	Sommers, 1998	SEPT	OLS	Equity
	Frick et al., 2003	WP.	FE, RE	Neither supported
	Marchand et al., 2006	TP, PO, DV, CF, SC	OLS, Logit	Tournament for TP, PO. Neither supported for DV, CF, SC
National Football League	Frick et al., 2003	WP.	FE, RE	Neither supported
	Mondello & Maxcy, 2009	WP	OLS, FE.	Equity
Soccer	Franck & Nüesch, 2011	WP	2SLS team fixed effects	Equity

WP, DT, LC, WC denotes Winning Percentage, Division Title, League Championship, World Championship, respectively. HA denotes total Home Attendance, SEPT denotes Season-Ending Point Total, RTP indicates Ratio of Team Points (Home / Away), and CV means Coefficient of Variation. FP represents Finishing Position, which is the number of games behind the team's division leader at season's end. TP, PO, DV, CF, SC denotes Team Points, whether the team made playoffs, whether the team won the division, whether the team won the conference and whether the team won the Stanley Cup, respectively. OLS, FE, RE denote Ordinary Least Squares, Fixed Effect estimator and Random effects estimator. SF and GMM represent the Stochastic Frontier model and Generalized Method of Moments, respectively.

Table 2. Details of teams in each year (Source – www.iplt20.com)

Number of teams	Years	List of Participating teams*#
8	2008	Chennai Super Kings, Deccan Chargers, Delhi Capitals, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Rajasthan Royals, Royal Challengers Bangalore
	2009	
	2010	
10	2011	Kochi Tuskers Kerala, Pune Warriors India, Chennai Super Kings, Deccan Chargers, Delhi Capitals, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Rajasthan Royals, Royal Challengers Bangalore
9	2012	Chennai Super Kings, Deccan Chargers, Delhi Capitals, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Pune Warriors India, Rajasthan Royals, Royal Challengers Bangalore
	2013	Chennai Super Kings, Delhi Capitals, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Pune Warriors India, Rajasthan Royals, Royal Challengers Bangalore, Sunrisers Hyderabad
8	2014	Chennai Super Kings, Delhi Capitals, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Rajasthan Royals, Royal Challengers Bangalore, Sunrisers Hyderabad
	2015	
	2016	Delhi Capitals, Gujarat Lions, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Rising Pune Supergiants, Royal Challengers Bangalore, Sunrisers Hyderabad
	2017	
	2018	Chennai Super Kings, Delhi Capitals, Kings XI Punjab, Kolkata Knight Riders, Mumbai Indians, Rajasthan Royals, Royal Challengers Bangalore, Sunrisers Hyderabad
	2019	

*Delhi Capitals was named as Delhi Daredevils till 2018

Ownership of Deccan Chargers got changed, and the team was renamed as Sunrisers Hyderabad in 2013

Table 3. Descriptive statistics

Year	Mean Total Salary(INR)	Std. Dev. Total Salary	Mean Win Percentage	Std. Dev Win Percentage	Mean Gini Coefficient	Std. dev Gini Coefficient
2008	23,47,86,750	3,72,85,433	49.11	21.06	0.622	0.045
2009	27,81,35,950	4,65,76,226	47.95	14.59	0.661	0.057
2010	25,20,20,413	5,79,60,031	48.81	13.48	0.645	0.029
2011	39,84,40,000	3,83,67,768	47.02	11.16	0.639	0.042
2012	45,51,94,572	10,27,43,287	48.56	14.98	0.654	0.038
2013	45,69,01,330	12,47,62,404	48.76	17.79	0.656	0.021
2014	58,93,75,000	1,97,71,462	49.04	20.40	0.597	0.061
2015	57,73,06,250	3,74,06,459	48.25	15.89	0.630	0.051
2016	57,04,27,778	6,71,53,367	49.34	11.73	0.608	0.047
2017	60,11,50,000	5,64,75,134	48.13	15.43	0.638	0.071
2018	72,01,50,000	4,87,56,626	49.36	10.90	0.552	0.065
2019	76,09,37,500	5,44,12,077	49.21	13.32	0.556	0.046
Sample Mean	49,12,35,462	5,76,39,190	48.63	15.06	0.621	0.048

Table 4. Ten highest team-specific Gini coefficients, 2008-2019

Rank	Team	Salary Dispersion (Gini)	Win Percentage (%)
1	2009, Royal Challengers Bangalore	0.7367	55.00
2	2017, Rising Pune Supergiants	0.7342	62.50
3	2011, Mumbai Indians	0.7030	61.90
4	2017, Gujarat Lions	0.6967	28.60
5	2017, Royal Challengers Bangalore	0.6964	23.10
6	2009, Rajasthan Royals	0.6959	38.50
7	2012, Deccan Chargers	0.6957	26.70
8	2014, Royal Challengers Bangalore	0.6907	35.70
9	2009, Deccan Chargers	0.6900	50.00
10	2010, Deccan Chargers	0.6894	50.00

Table 5. Definition and measurement of variables

Variables	**Definition and Measurement**
DEPENDENT	
$WinPercentage_{jt}$	Team 'j' winning percentage in year 't' = (No. of Wins/No. of matches played)
INDEPENDENT	
$WinPercentage_{jt-1}$	Team 'j' winning percentage in the previous year
$Dispersion_{jt}$	Gini coefficients are calculated considering the salaries of all players in team 'j'
$log(TotalSalary)_{jt}$	Logarathim of Total team salary considering all players in team' j'
$ProportionofTotalSalary_{jt}$	The ratio of team 'j' payroll to the total league payroll for the year 't'
$Year_t$	A monotonic time trend variable
$CaptainChange_{jt}$	Change in Captain from previous year (Yes = 1 , No = 0)
$CoachChange_{jt}$	Change in Head Coach from previous year (Yes = 1, No=0)
$Captain\_Indian_{jt}$	Team captain is Indian player (Indian = 1, Foreigner = 0)
$ActivePlayers_{jt}$	Number of players participated in current year

Table 6. Effect of salary dispersion on team performance, with TotalSalary as the measure of payroll

Dependent variable: $WinPercentage_{jt}$						
Variables	Random effects			GMM		
	Coefficient	Robust Std Error	p-value	Coefficient	Robust Std Error	p-value
$WinPercentage_{jt-1}$				-0.109	0.110	0. 325
$Dispersion_{jt}$	34.525	29.267	0.238	56.487**	24.264	0.020
$log(TotalSalary)_{jt}$	-6.086	7.278	0.403	-4.927	7.831	0.529
$CaptainChange_{jt}$	-2.789	3.243	0.390	-4.057*	2.283	0.076
$CoachChange_{jt}$	2.864	3.089	0.354	5.785	5.392	0.283
$Captain\_Indian_{jt}$	5.818*	3.244	0.073	7.763	5.628	0.168
$ActivePlayers_{jt}$	-2.132***	0.702	0.002	-1.003	0.962	0.297
Year	0.633	0.939	0.500	1.081	0.709	0.127
γ_0 (constant)	-1087.302	1777.287	0.541	-2044.567	1319.891	0.121
R-squared		0.1966				
Pr > chi2		0.006				
AR(1) test of residuals						0.055
AR(2) test of residuals						0.112

*** significance at 1% level, **significance at 5% level, *significance at 10% level

Table 7. Effect of salary dispersion on team performance, with ProportionofTotalSalary as the measure of payroll

Variables	Dependent variable: $WinPercentage_{jt}$					
	Random effects			GMM		
	Coefficient	Robust Std Error	p-value	Coefficient	Robust Std Error	p-value
$WinPercentage_{jt-1}$				-0.110	0.108	0.309
$Dispersion_{jt}$	32.539	29.000	0.262	53.083**	21.551	0.014
$ProportionofTotalSalary_{jt}$	-60.383	79.444	0.447	-115.704**	56.935	0.042
$CaptainChange_{jt}$	-3.130	3.186	0.326	-4.522*	2.572	0.079
$CoachChange_{jt}$	2.818	3.092	0.362	5.760	5.060	0.255
$Captain\_Indian_{jt}$	6.054*	3.344	0.070	8.413	5.320	0.114
$ActivePlayers_{jt}$	-2.021***	0.678	0.003	-0.924	0.860	0.283
Year	0.051	0.531	0.922	0.585	0.592	0.323
γ_0 (constant)	-31.793	1075.833	0.976	-1128.712	1200.069	0.347
R-squared		0.195				
Pr > chi2		0.006				
AR(1) test of residuals						0.051
AR(2) test of residuals						0.105

*** significance at 1% level, **significance at 5% level, *significance at 10% level

Figure 1. Win percentage of Bangalore and Mumbai teams

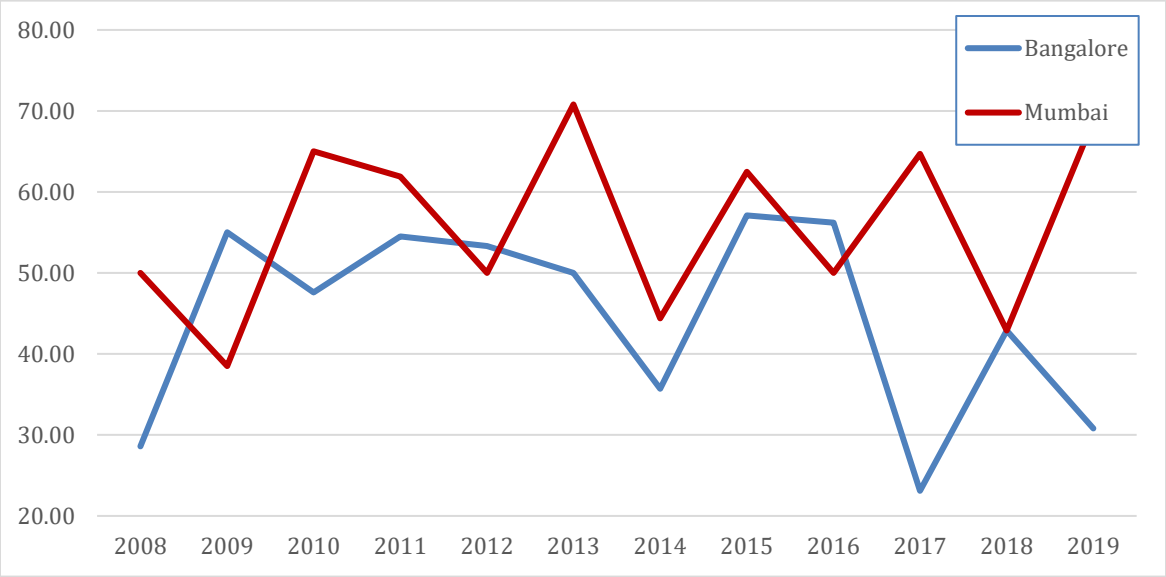
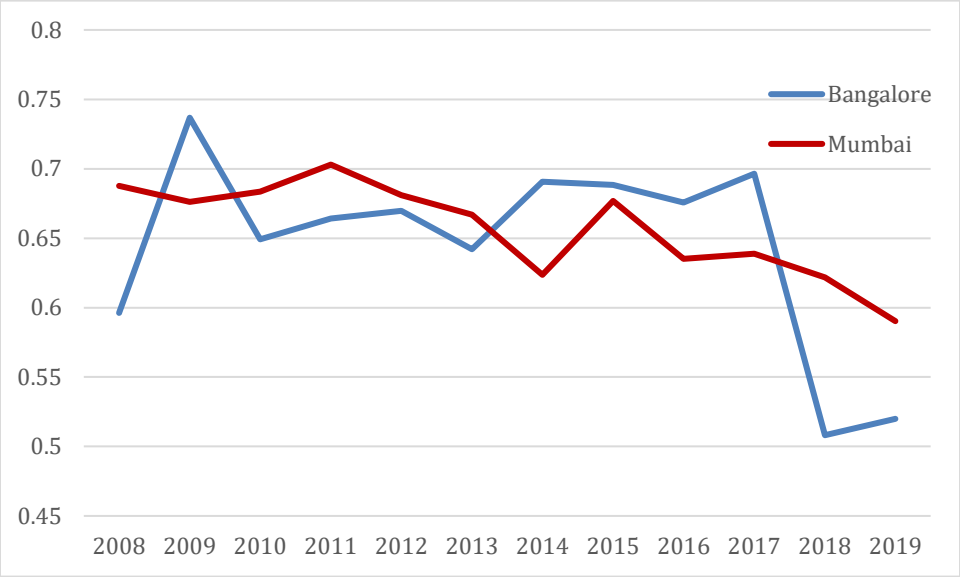


Figure 2. Salary Dispersion of Bangalore and Mumbai teams



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