Pay Inequalities and Team Performance: Empirical Evidence from the North American Major Leagues

Bernd Frick & Joachim Prinz & Karina Winkelmann

Discussion Paper No. 02-28

GERMAN ECONOMIC ASSOCIATION OF BUSINESS ADMINISTRATION – GEABA
Pay Inequalities and Team Performance:  
Empirical Evidence from the North American Major Leagues

Bernd Frick, Joachim Prinz and Karina Winkelmann*

* We are especially grateful to Rob Simmons for his helpful suggestions. Moreover, we thank the participants of the 79th annual meeting of the Applied Econometrics Association at the Free University of Bruxelles for their comments. Any remaining errors are, of course, our own.
Abstract

The impact of pay structure on organizational performance has long been a topic of economic research. Tournament theory emphasizes the positive incentive effects induced by wider pay differentials whereas equity theory predicts that a more compressed pay structure is performance-enhancing because it pays attention to the employees’ fairness considerations. We use a unique and rather large data set from the four North American Major Leagues to address the question how wage disparities affect the performance of professional sports teams. Since our findings are difficult to reconcile with either one of the two theoretical approaches, we suggest an explanation that also pays attention to the specific conditions under which team production takes place.

Keywords: Pay Inequality, Performance, Tournament Theory, Equity Theory

*JEL-Classification: J31, M52*
1. **Research Question**

Wage disparities and their consequences have long been a topic of economic research. While most papers focus on describing the development of wage differentials over time and seek to identify the reasons for the observed patterns, few attempts have been made to analyze the influence of pay inequality on economic outcomes. We use a unique and rather large data set to address the question how wage disparities affect the performance of professional sports teams. The reasons for such an exercise are manifold: First, from a theoretical point of view, the mutual interdependencies among the players are obvious, hence the term “team sports”. Second, the wage data necessary to calculate alternative measures of intra-team wage dispersion are readily available and, third, a clear performance measure – the number of games won during the (regular) season – is also available. Thus, sports provides the ultimate avenue for examining business and management practices: Due to data availability on the one hand and the high degree of competition in the industry, “sports can serve as a laboratory enabling the examination of propositions that might take decades or longer in other sectors of the economy. … For instance, the data enable scholars to examine the effects of alternative allocation schemes, of business personnel practices, … and other issues” (Boyes 1994: 399, with similar arguments Kahn 2000).

2. **Previous Evidence**

Two different strands of literature deserve to be reviewed in the context of this paper: On the one hand, some papers have investigated the impact of pay equity on the performance of either large manufacturing firms (Cowherd and Levine 1992) or the influence of wage dispersion within academic departments on the productivity of individual researchers in a representative sample of American colleges and universities (Pfeffer and Langton 1993). On the other hand, a number of papers have studied the influence of salary differentials on the performance of either professional baseball teams (Harder 1992, Richards and Guell 1998, Bloom 1999, Depken 2000 and DeBrock, Hendricks and Wallace 2001), hockey teams (Gomez 2002) or soccer teams (Lehmann and Wacker 2000).

---

1. During the last decade these issues have been increasingly discussed by experimental economists. An rapidly growing number of studies based on laboratory field research suggest that social norms, equity and fairness play key roles in understanding individual behavior (see Rabin 1998, Gächter and Fehr 2002, Fehr and Falk 2002).

2. Further performance measures that will be used in future research include the number of tickets sold per game, total revenues (including TV- and merchandising income) as well as profits (either before or after tax).
Based on a non-representative sample of about 100 large manufacturing firms, Cowherd and Levine (1992) find that – other things equal – their composite measure of hourly pay equity (defined as “pay of hourly employees relative to the pay of the top three levels of management”) has a statistically significant and economically relevant negative influence on product quality as perceived by customers. The authors argue that product quality is an especially well suited dimension of firm performance to be studied in this context: Since quality is difficult to control by management, it is largely a function of the willingness of lower-level employees to contribute more than their organizations can require of them in their formal roles. Thus, the degree of pay equity experienced by lower-level employees is likely to have a substantial influence on product quality by affecting extrarole behavior in the forms of goal commitment, effort, and cooperation³.

Pfeffer and Langton (1993) use data from about 17,000 college and university professors from 600 different academic departments located in some 300 institutions to study the influence of wage dispersion on individual satisfaction, research output, and the willingness to work collaboratively on research. The authors find that salary dispersion (measured by the coefficient of variation of individual salaries within the department) has a significantly negative influence on current as well as long-term research productivity. Moreover, it negatively affects job satisfaction as well as the individual’s readiness to work collaboratively on a research project.

A major methodological problem that both studies have in common is that they rely on cross-sectional data, that does not allow a clear cut identification of cause and effect: Is poor product quality the result of a large pay gap between management and shop-floor workers or do firms producing poor quality hire expensive managers to cope with their obvious problems? Is a poor publication record the consequence of a large wage differential or do such differentials follow from the fact that some individuals publish far less than the average scientist in their respective academic discipline does?

The studies that have used data from professional team sports by and large conclude that a higher wage disparity is – other things equal – detrimental to team performance, i.e. teams with higher degrees of salary dispersion typically have worse win-loss-percentages during the regular season. However, while the findings reported by Depken (2000) and by Lehmann and Wacker (2000) unequivocally support the “salary compression hypothesis”, the evidence presented by Harder (1992), Richards and Guell (1998),

³ Moreover, Winter-Ebmer and Zweimüller (1999) use standardized wages for blue- and white-collar workers as a measure of firm performance. They find that the earnings of white-collar workers react in a hump-shaped way to wage inequality in the firm while in the case of blue-collar workers the standardized wage increases with wage dispersion. The authors concede that their findings are difficult to reconcile with the available theoretical arguments.
Bloom (1999), Gomez (2002) and DeBrock, Hendricks and Koenker (2001) is mixed: Harder (1992) uses individual data from four Baseball seasons (1976, 1977, 1987 and 1988) and one Basketball season (1987). He finds only partial support for what he calls the “pay equity hypothesis” (underreward leads to selfish behavior, while overreward leads to cooperative behavior) for Basketball, but much less so for Baseball. His rather ad hoc explanation is that the former sport can be characterized by a “reciprocal interdependence” among the players while the latter is dominated by something labelled “pooled interdependence”. Using team data for the seasons 1992, 1993 and 1995, Richards and Guell (1998) in turn find that the variance of team salaries has a significantly negative (at the 90%-level) influence on the win percentage of professional Baseball teams, but not on the probability of winning a divisional title, a league or a world championship. The data set used by DeBrock, Hendricks and Koenker (2001) covers 378 observations on Major Leagues Baseball teams for the time period 1985 through 1998. Their findings suggest that unconditional measures of inequality tend to exaggerate the influence of wage disparity on team performance. Thus, their conditional measures (derived from the residual of individual level wage regressions) reveal a more modest impact of pay inequality on the win-loss record of professional baseball teams. Gomez (2002) analyses team data from five consecutive ice hockey seasons (1993/94-1997/98) and receives “tentative confirmation” for his “social capital hypothesis” (suggesting that social capital is harmed in an organization that treats its labor input simply as a variable cost of production in need of minimization rather than a fixed cost of production), because the results proved to be sensitive to the time periods used. Finally, Bloom (1999) uses individual as well as team salaries from Baseball for the seasons 1985-1993 to analyse the impact of pay dispersion on the performance of single players as well as teams. On the one hand he finds a significantly negative influence of pay dispersion on the winning percentage, the attendance figures, the finishing position, gate receipts, media income, and franchise value, while on the other he concludes that “(g)reater dispersion is negatively related to the performance of those lower in a dispersion and positively related to the performance of those higher in the dispersion” (Bloom 1999: 32). If the latter group of players – most likely the “stars” – have a greater impact on the performance of their team, it is not at all clear whether teams benefit or suffer from a more compressed wage structure. Summarizing, it appears that the available evidence is not very compelling yet. To the best of our knowledge, our paper is the first that attempts to measure the impact of pay inequalities on the performance of professional sports teams across different leagues. This, in turn, enables us to control implicitly for the possible influence of different institutional regimes and production technologies.
3. Competing Hypotheses and Testable Implications

Assuming that the compensation of an organization’s members must be treated as an entire structure and not as a collection of separately determined components, it would be misguided to examine the wage level of one employee to determine its correctness without placing it in the context of the entire hierarchy (Lazear 1995). Thus, a key question for every organization is whether a “hierarchical” pay structure, i.e. one which pays considerably more for top talent, has positive consequences for team-wide performance, that is whether an unequal distribution of pay provides high-powered incentives. On the other hand, a “compressed” wage structure may be beneficial when collaboration and task complexity necessitate the involvement of most – if not all – employees working in concert.

We derive testable predictions from the works of Kandel and Lazear (1992), Levine (1991) and Frank (1985) on the one hand and from Ramaswamy and Rowthorn (1991) on the other hand. While the former authors emphasize the importance of a more compressed wage structure, the latter two point to the benefits of a more hierarchical one. Lazear (1989: 579) for example argues as follows (see also Drago and Garvey 1998; Levine 1993):

“If harmony is important, pay compression is optimal on strict efficiency grounds”.

This means that the more important harmony is for the team’s output, the more equal the pay distribution will have to be. Levine (1991) develops a model with two types of labor in which greater wage disparity between high-skill and low-skill workers is detrimental to team cohesiveness and team production. As the tasks of the workers become more complementary, the greater the marginal effect of shirking on team productivity. Hence, a more pronounced pay inequality should have a negative influence on team performance. Frank (1985), in turn, argues that a compressed wage structure is beneficial for the more able as well as the less able team members: The top performers derive utility from the fact that they are “on top of the team” and are therefore willing to sacrifice part of the incomes they would otherwise earn. The weaker team members, in turn, must be compensated for accepting their inferior role by paying them more than they would deserve if only their performance counted.

---

4 The concrete labelling (“theories of social comparison”, “efficiency wage theories”, etc.) is less important than the “content” of the theories that are of relevance in the context of our paper. We group the theories in a cluster emphasizing the importance of “compressed” wage structures and in one emphasizing the importance of “hierarchical” pay systems. It should be noted, however, that the neoclassical theory of wage determination “has nothing to say about fairness” (Rees 1993: 243).
Hence, the optimal degree of pay inequality depends upon the type of behavior the firm wants to encourage and the ability to monitor performance. Greater dispersion is likely to induce higher levels of effort if the individual’s performance can be measured, if risk-taking behavior is to be encouraged, if the individual tends not to affect the performance of others and if cooperative team efforts are not important. Conversely, a more egalitarian pay structure may be merited if risk-taking behavior is not important, if it is difficult to disentangle the individual’s performance from that of the team, if the team members affect each other’s performance in ways that are difficult to measure and reward and if team effort is important (see also Gunderson 2001). The conflicting view is based on a model in which different types of labor have different “damage potential”, i.e. worker-specific risk to efficient team production. According to this view, workers with greater damage potential should be paid more in order to mitigate their desire to threaten the team’s productivity. This implies that wage disparity should have at least a non-negative impact on team productivity. Apart from these seemingly incompatible theoretical positions, it is also far from clear, whether the relationship between pay dispersion and team performance is time invariant and/or independent of context factors:

“(S)tudies of the effects of pay systems need to pay close attention to both the particular context and to factors that moderate the relationship between pay and its outcomes. … It is quite likely that the effect of pay dispersion and pay-performance linkage varies depending on the degree of interdependence of the task and technology, … and the ease of evaluating the work output” (Pfeffer and Langton 1993: 404).

Therefore, we analyze the influence of wage dispersion on team performance across four different team sports leagues that can be characterized by different degrees of mutual interdependencies between the players and/or different cooperation requirements.

4. Data, Methodology and Empirical Findings

Since data on the distribution of incomes within firms is rather difficult to collect, we use information on the salaries paid by Major League teams to their individual players. The team sports industry is especially suited for an empirical analysis like the one conducted here, because all “firms” face the same technical and legal constraints, use the same input factors, have an identical production function and face each other in a highly

5 Egalitarian pay structures that are based on the performance of the team suffer may from the “1/N-problem”: Individual effort to the team yields a return of 1/N only which can be very small if the team is large (Holmstrom 1982). However, in small teams – as in all professional sports leagues – peer pressures and peer rewards are likely to mitigate this problem (Kandel and Lazear 1992).
competitive environment. Nevertheless, these firms still differentiate their pay systems. We use win percentage in the regular season as a measure of team performance and the Gini-index as our measure of pay inequality\(^6\).

Our data comes from up to sixteen consecutive seasons in the different Major Leagues in Baseball (1985-2001), Basketball (1990-2000), Football (1988, 1991, 1995-2000) and Hockey (1988, 1993, 1995-2000). This gives us exactly 1,224 team-year observations that allow estimation of fixed- and random-effects models. The former model may be appropriate because as a rule in any given year all teams are included in the respective samples. However, as team effects may be random due to unknown or unmeasurable influences on team performance, we also estimated random effects models. For the sake of brevity, we report only those estimates that are to be preferred on statistical grounds.

In each of the estimates, the Gini-index as our disparity measure and the (log of) the total wage bill serve as the most important independent variables and the win percentage as the dependent variable\(^7\). Our estimated models are of the general following form:

\[
WP = \alpha_0 + \alpha_1 \text{GINI} + \alpha_2 \text{LNPAY} + \alpha_3 \text{NOP} + \sum \text{TD} + \sum \text{JD} + \varepsilon
\]

where
- WP: win percent during regular season
- GINI: measure of wage disparity
- LNPAY: natural logarithm of annual wage bill
- NOP: number of players on roster
- TD: vector of team dummies
- JD: vector of year dummies

Our empirical analysis proceeds in two steps. First, we document changes in intra- and inter-team wage inequality. It turns out, that wage inequality has increased considerably over the last fifteen years\(^8\), which may be interpreted as an indicator that inequality cannot be detrimental to team performance (otherwise teams would have preferred stable distributions). Such a conclusion, however, is rather premature, because rising wage inequality in professional team sports is exactly what Rosen’s (1981) theory of superstars predicts to occur when the development of broadcasting technologies allows a

---

\(^6\) In future work, we will complement our estimates by using additional measures of pay inequality, such as the Herfindal-index, the coefficient of variation and some measure of skewness.

\(^7\) We control, of course, also for the number of players on a team’s roster as well as for changes in the institutional environment, such as the emergence of expansion teams and team relocations. These latter factors, however, have no influence on team performance. In further research we intend to include inter alia a dummy variable “firing the head coach during the season” as a potential determinant of team performance.

\(^8\) For figures relating to the 1960s and 1970s and showing a significantly lower degree of pay inequality see Porter and Scully (1996: 160).
world-wide marketing of especially talented actors, singers, or athletes (see Figures 1-5 in the appendix and the empirical evidence presented by Frick 2001). Second, we directly analyze the impact of wage inequality on team performance. Overall, our results neither support the cohesion and/or harmony-hypothesis nor the damage potential argument. Summarizing, our results differ to a considerable extent between the four leagues, which is not surprising, given the different degrees of “cooperation requirements” on the one hand and the specificities of the respective production functions on the other hand.9

Table 1
Income Inequality and Team Performance in the NBA
(Dependent Variable: Win Percent; Preferred Estimate: Fixed Effects#)

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>T</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GINI</td>
<td>.277</td>
<td>.105</td>
<td>2.62</td>
<td>***</td>
</tr>
<tr>
<td>LNPAY</td>
<td>.144</td>
<td>.049</td>
<td>2.93</td>
<td>***</td>
</tr>
<tr>
<td>NOP</td>
<td>-.022</td>
<td>.003</td>
<td>-6.35</td>
<td>***</td>
</tr>
<tr>
<td>Year Dummies</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONST</td>
<td>-1.659</td>
<td>.778</td>
<td>-2.13</td>
<td>***</td>
</tr>
<tr>
<td>R²*100</td>
<td>47.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-Value</td>
<td>3.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Cases</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Observations</td>
<td>309</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** p < .01

# Robust t-values; Hausman test: χ² = 34.89; p < .01; LM-test: χ² = 75.04; p < .01

According to our estimates (and contradicting the findings presented by Harder (1992)), a higher degree of intra-team wage dispersion is beneficial to the performance of professional Basketball teams (see Table 1), i.e. a team is more successful as its pay distribution becomes more “unequal”. In hockey, the coefficient has also a positive sign, but is not significantly different from zero (see Table 2)10. This once again contradicts the available evidence (see Gomez 2002) but can probably be explained by the fact that due to the specific production function the number of players is rather low in both industries: In hockey as well as in basketball only a small number of players per team are allowed on the ice or the court. This implies that a single “star player” may be of para

9 In all of our specifications, the log of the annual wage bill has the expected positive influence on team performance, suggesting that more talented and therefore more expensive players are one of the most important “ingredients” for professional teams (with similar findings Forrest and Simmons 2002).

10 Since our dependent variable is constrained to lie between 0 and 1, we also estimated our models using a transformed win percentage (i.e. the log odds, ln(win percentage / (1-win percentage)). Since this did not have an impact on our results, we do not report the findings here. They are, however, available upon request.
mount importance for the team’s performance – which, in turn will lead to a highly skewed distribution of player salaries without negatively affecting the performance of those at the lower end of the pay hierarchy.

Table 2
Income Inequality and Team Performance in the NHL
(Dependent Variable: Win Percent; Preferred Estimate: Fixed Effects*)

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>GINI</td>
<td>0.041</td>
<td>0.149</td>
<td>0.28</td>
</tr>
<tr>
<td>LNPAY</td>
<td>0.098</td>
<td>0.042</td>
<td>2.34</td>
</tr>
<tr>
<td>NOP</td>
<td>-0.009</td>
<td>0.002</td>
<td>-4.17</td>
</tr>
<tr>
<td>Year Dummies</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONST</td>
<td>-0.856</td>
<td>0.590</td>
<td>-1.45</td>
</tr>
<tr>
<td>R² * 100</td>
<td>35.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-Value</td>
<td>2.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Cases</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Observations</td>
<td>210</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* not significant; *** p < .01

# Robust t-values; Hausman test: χ² = 24.39; p < .01; LM-test: χ² = 3.51; p < .10

Table 3
Income Inequality and Team Performance in the NFL
(Dependent Variable: Win Percent, Preferred Estimate: OLS#)

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>GINI</td>
<td>-0.586</td>
<td>0.313</td>
<td>-1.87</td>
</tr>
<tr>
<td>LNPAY</td>
<td>0.548</td>
<td>0.111</td>
<td>4.93</td>
</tr>
<tr>
<td>NOP</td>
<td>-0.016</td>
<td>0.003</td>
<td>-5.60</td>
</tr>
<tr>
<td>Year Dummies</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONST</td>
<td>-8.063</td>
<td>1.887</td>
<td>-4.27</td>
</tr>
<tr>
<td>R² * 100</td>
<td>12.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-Value</td>
<td>4.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Cases</td>
<td>237</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .10; *** p < .01

# Robust t-values; LM-test: χ² = 2.38; n.s.

Since the size of the squad required for every match as well as for a successful season is significantly higher in baseball and football, an individual player’s impact on the performance of his team is likely to be much smaller in the latter two team sports than in either basketball or hockey. Consistent with this hypothesis, we find that in football and in baseball a higher degree of inequality is associated with a poorer performance: The
more unequal the distribution of pay, the lower is c.p. the win percentage of the teams under consideration\textsuperscript{11}.

Table 4
Income Inequality and Team Performance in the MLB
(Dependent Variable: Win Percent; Preferred Estimate: Random Effects\textsuperscript{#})

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>GINI</td>
<td>-.163</td>
<td>.062</td>
<td>-2.63</td>
</tr>
<tr>
<td>LNPAY</td>
<td>.008</td>
<td>.003</td>
<td>2.51</td>
</tr>
<tr>
<td>NOP</td>
<td>-.001</td>
<td>.001</td>
<td>-0.74</td>
</tr>
<tr>
<td>Year Dummies</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONST</td>
<td>0.495</td>
<td>.075</td>
<td>6.61</td>
</tr>
<tr>
<td>R\textsuperscript{2} * 100</td>
<td>37.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Groups</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Observations</td>
<td>468</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ not significant; *** p < .01

\textsuperscript{#} Robust t-values; Hausman test: $\chi = 16.24$; n.s.; LM-test: $\chi = 7.60$; p < .01

Of course, on could argue that the proper technology involved in winning games requires a relatively equal set of talented players on the roster, and hence a relatively flat salary profile. Teams with a small number of stars and the rest of the positions filled with average or young players will have a larger inequality of earnings and will therefore be less effective on the field. Since we compare the impact of pay structures on team performance not only over time, but also across four different leagues, it is not very likely that our findings are driven by such a distribution of playing talent. However, in order to explore this argument further, it is necessary to complement our findings with estimates from Mincer-type earnings functions based on individual players’ performance measures. Adding team dummies to these estimates will not only allow identification of teams pursuing a high-wage and a low-wage strategy, but will also enable us to analyze the reactions of individual players who are either over- or under-rewarded.

Apparently, compensation strategies are rather complicated in nature. They require decisions not only on the quality of workers, but also on the structure of compensation and

\textsuperscript{11} Moreover, the negative influence of squad size on the win percentage (in three out of four estimates) may also support the “cohesion” or “fairness hypothesis”: In larger teams, disharmony may be higher as a number of players cannot get a starting position. At the same time, the negative effect may be due to the fact that injuries of starting players have induced team owners to hire players to replace the injured ones (with the predictable consequences for the performance of the team). Finally, a large squad may either be the result of the arrival of a new head coach (who subsequently starts to hire his favourite players) or simply reflect the current coaches’ frustration with the quality of his squad (inducing him to hire new players, who again do not fulfill the expectations).
on the role of motivation and fairness. All these decisions, in turn, depend on the technology of the industry.

5. Implications for Further Research

Our findings suggest that none of the competing hypothesis is fully supported, nor finally rejected. Depending on the specific circumstances of the production process (especially size of the team and cooperation requirements) a higher degree of wage inequality can have a positive as well as a negative influence on team performance. Further research in this area should address the question how individuals react to intra- and inter-team wage inequalities (for a first attempt in that direction see Harder 1992 and Hamilton 1995). Moreover, looking at the specific situation in professional team sports it is certainly interesting to take a closer look at the different policies that have been pursued in some of the Major Leagues to curtail total spendings (such as salary caps and luxury taxes) and to ask whether these have any influence on intra-team salary structure and – therefore – also on team-performance.
Literature