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Testing Fair Wage Theory

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Abstract

Fairness considerations often are invoked to explain wage differences that appear unrelated to worker characteristics or job conditions, but non-experimental tests of fair wage models are rare and weak because of the limits of available market-generated data. In particular, such data rarely permit researchers to (a) identify suitable reference points that employees and employers might use in determining what is fair and (b) control for employees' marginal output and its value. This study utilizes a unique dataset from the baseball labor market that solves both problems. We find no support for fair wage theory in this market. We also find that fairness premia can be illusory: Wages appear to be adjusted upward for reasons of fairness in regressions that control for variation in individuals' physical output, but such premia evaporate when the value of that output (which can be market- or firm-specific) is held constant. This suggests that avoiding proxy measures of workers' marginal revenue products in wage studies might reduce the number of labor market "anomalies" economists must resolve.

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I. Introduction

The existence of wage differences among observationally equivalent workers has spawned a vast literature seeking to explain this apparent violation of the law of one price. This effort has been very fruitful, enhancing economists' interest in behavioral analysis of market phenomena and leading to many refinements of classical price theory. In this study we focus on one of those refinements: the potential role of fairness considerations in determining the structure of wages. If, for example, secretaries are paid more in the auto industry than in education and this wage premium is not explained by differences in worker quality and/or working conditions, then it is plausible to suppose fairness norms may explain some of the variance. That is, if auto assembly line workers receive supra-competitive wages by virtue of their unions' bargaining power, perhaps it is necessary or desirable to pay secretaries and other (non-unionized) workers in the industry wages above their opportunity costs, which we would call *fairness premia*. Failure to do so might lead these workers to conclude they are being treated inequitably and to reduce their level of effort or become less cooperative, as Akerlof and Yellen (1990) have suggested.

Many experiments and surveys have shown that fairness concerns are potentially important influences on employer and employee behavior, but there is little direct evidence that such concerns explain much observed variation in wages across or within industries. Part of the problem is that the large datasets typically studied contain much descriptive detail on firm and worker characteristics but little on individual performance.

In consequence, it is difficult to link observed wages to variables suggested by fair wage models, and it is often impossible to hold constant what is most important in explaining wages: variation in the value of workers' output. Accordingly, we propose to analyze wage-setting in a single industry where we can avoid such problems.

In the baseball labor market, detailed and comprehensive data on employers' revenues, employees' output, and compensation enable us to construct variables needed to detect the presence of possible fairness premia. What is more, these data are rich enough to measure not just an individual's marginal physical product but its value. This, it turns out, is an important distinction: Merely controlling for variation in individual productivity (or productive capacity) in wage regressions may yield a distorted picture, for the value of a given employee's output can vary considerably among employers due to differences in their market size or power. We find that regressions which control for variation in workers' physical productivity yield evidence consistent with fair wage models of employer behavior, but when we hold constant workers' marginal revenue products (MRPs) this evidence evaporates. So, while we ultimately find no support for fair wage theory in this market, this study demonstrates that imprecise or omitted measures of the value of workers' output in studies of observed wage differences can lead to biased estimates of the contribution of fairness (or perhaps other, related behavioral concerns) to the structure of wages.[1]

In the next section we briefly summarize the literature on wage differentials and fair wage models. Section III provides necessary institutional information on and

[1] The idea that mis-measured (or unobservable) differences in workers' productive capacity might play a large role in explaining observed wage differences was advanced by Murphy and Topel (1987) and further investigated by Gibbons and Katz (1992) and by Abowd, Kramarz, and Margolis (1999). In effect, the present study suggests that even where ability differences are observable and measured perfectly, bias problems remain in wage regressions that do not contain workers' MRPs because of variation in the value of otherwise-identical workers' output from one industry or employer to another.

analysis of the wage-setting process in the baseball labor market. Section IV proceeds to direct tests for the presence of fairness premia in this market using two distinct data samples and a variety of specifications. In both samples and in all specifications we find evidence of an *illusory* fairness effect—i.e., we detect fairness premia that disappear once accurate measures of individuals' MRPs are included in wage regressions—and so conclude that fairness concerns are unimportant in explaining wage differentials in this market. The final section considers whether our findings have broader implications for the literature on the structure of wages.

II. The Literature on Wage Differences and Fairness

There is a positive relationship between firm size and wages that is well-established, intertemporally stable, and internationally pervasive (see, e.g., Moore 1911, Brown and Medoff 1989; Oi and Idson 1999). In addition, there is abundant evidence that certain industries pay higher wages than others, that inter-industry wage premia are not entirely explained by variance in worker characteristics or job conditions, and that such differences persist over time and across countries (Dickens and Katz 1987; Krueger and Summers 1988; Abowd, Kramarz, and Margolis 1999).

In part to explain these facts, economists have developed several sophisticated refinements of classical price theory. Among these are (i) the theory of compensating differentials, in which workers' pay in certain firms or industries reflects the presence (absence) of various unfavorable (favorable) working conditions (Rosen 1986); (ii) agency theory, in which the costs of monitoring employees affects firms' decisions about the quality and compensation of those they will hire (Oi 1983); (iii) efficiency-wage models, in which supra-competitive wages may be profit-maximizing because they enable firms to reduce shirking (Shapiro and Stiglitz 1984) and turnover (Salop 1979), tap into a higher-quality job applicant pool (Weiss 1980), or avoid unionization (Dickens 1986); and (iv) fair wage models, in which the degree to which workers exert effort or behave cooperatively is tied to their perceptions that they are being paid fairly (Akerlof and Yellen 1990). The present study focuses on the latter.

As economists have sought to incorporate the insights of psychologists in their models of market behavior, fairness considerations have become increasingly popular in explaining a variety of market anomalies, and there is ample experimental evidence that standards of fairness may have a role to play in explaining the structure of wages. For example, several early experimental studies found that subjects reduced the quality of their work when paid less than the "going rate" (Lawler and O'Gara 1967), that arbitrary wage reductions led to reduced work quality and higher quit rates (Valenzi and Andrews 1971; Pritchard, Dunnette, and Jorgenson 1972), and that pay inequalities reduced cooperation (Schmitt and Marwell 1972). In a more recent experiment, subjects acting as employers were found to offer above-market wages in the hope that their workers would respond with higher levels of effort—and, on average, the subjects acting as employees did so (Fehr, Kirchsteiger, and Reidl 1993). There is also much anecdotal (Rees 1993) and survey evidence (Kahneman, Knetsch, and Thaler 1986; Blinder and Choi 1990) that employers and workers frequently use (or say they use) fairness considerations as important guides in making real-world labor market decisions.

Yet there is remarkably little econometric evidence that fairness concerns are quantitatively significant in explaining observed differences in wages within and across industries. One major problem is that it can be difficult to assemble data on variables suggested by fair wage models, especially the reference points employees or employers might use to determine what is fair. As a result, researchers have often been limited to an approach that is sometimes referred to as "argument by elimination" (Krueger and Summers 1988, p. 281), in which as many non-fairness-related variables as possible (e.g., worker quality, working conditions, threat of unionization, demographics, and market concentration) are controlled for and remaining unexplained variance in wages is attributed to fairness considerations. The problem here is clear: the unexplained variance may also be tied to other omitted variables, including (but not limited to) unmeasured worker quality. Attempts to resolve this problem with longitudinal data that includes workers who have moved from one firm or industry to another have produced mixed results, with some researchers concluding that unobserved worker quality largely explains away the wage differentials (Murphy and Topel 1987; Shippen 1999) while others conclude the opposite (Gibbons and Katz 1992; Blackburn and Neumark 1992).

Nevertheless, there is considerable evidence (which appears to originate with Slichter 1950) that wage levels are correlated with an employer's ability to pay, whether measured by the firm's profitability or its market power. One recent study has found that, *ceteris paribus*, in U.S. manufacturing a doubling of profitability leads after some years to an eight percent increase in wages (Blanchflower, Oswald, and Sanfey 1996); another has found a positive correlation between profits and wages for Sweden (Arai 2003). Some have argued that such evidence supports fair wage models since "sharing rents is fair" (Thaler 1992, p. 45). Here again, however, there are competing explanations. Another recent study, for example, has found a positive correlation between wage *dispersion* and profits, and argues that this is more consistent with tournament-pay models, in which unequal rewards motivate greater effort, than with fair wage models (Lallemand, Plasman, and Rycx 2004).

By employing data from the major league baseball labor market, we believe we can avoid several of the problems that have arisen in studies of other industries. First of all, the availability of individual and team compensation data enables us to construct variables necessary to test fair wage models directly rather than via "elimination." Moreover, there is no need to use workers' characteristics (whether observed or unobserved) as proxies for their productive capacity in these tests, for detailed and accurate measures of individual players' marginal productivity are readily available, as are data about employers' financial performance and market structure that are needed to accurately measure the *value* of workers' output across firms. Finally, some of the considerations that make the interpretation of data across a large number of industries (e.g., working conditions that require compensating differentials, or the threat of unionization) are absent here, enabling a focus on fairness. Accordingly, this market provides a relatively clean and straightforward test of whether observed wage differences reflect fairness premia after controlling for variation in individual workers' MRPs.

III. The Baseball Labor Market and Employer-Specific MRPs

Thanks to the seminal work of Gerald Scully (1974) on pay and performance in baseball, calculating a ballplayer's MRP involves a relatively straightforward two-step process. One must first quantify the relationship between a team's revenue and its output of wins (holding constant other possible influences on consumer demand, such as the amenity of a team's stadium). Second, one must quantify each player's contribution of wins to his team (which is a by-product of myriad individual performance measures, from home runs or stolen bases for hitters to putouts or errors for fielders to strikeouts or hits allowed for pitchers). Each player's MRP is then equal to his marginal physical product (in wins) times the value of marginal wins (in dollars) to his team.

One fact that is apparent to most observers of the baseball labor market is that the marginal revenue each team realizes for an extra game won—and therefore its players' MRPs—will be positively correlated with the size of the market in which it plays, all else equal. The greater the number of potential fans to whom a team can sell its products (not just tickets to games, but radio and television broadcasts and merchandise), the greater the revenue potential of each particular element of output players contribute on the field. In consequence, the same player will be worth more to large-market teams than small-market ones, so that the former may tend to accumulate a disproportionate amount of the available talent and win more than their fair share of games. In one early study (Sommers and Quinton 1982), the ratio of a player's MRP in the largest to the smallest market was found to be roughly 2:1. In recent years, however, the growth of pay-cable television has enabled teams to capture significantly greater revenue per potential consumer and has increased the importance of differences in the population base within teams' market areas.[2] Accordingly, Burger and Walters (2003) have estimated that the current ratio of a player's MRP in the largest to the smallest big-league market is roughly 6:1. For example, a player who could add five marginal wins (relative to an available alternative player) to his team's total output would have a MRP of $18.1 million per year

[2] In 1995, for example, locally-generated revenue (i.e., total revenue less receipts doled out equally to all clubs, such as national television rights fees) in the richest market exceeded that in the poorest by a ratio of 5.5:1. By 2001, that ratio was 22.3:1 (Levin, Mitchell, Volcker, and Will 2000; 2001).

in the largest market (New York, where the Yankees and Mets share over 20 million potential fans), \$8.1 million in a mid-sized market (Houston, with 4.5 million potential fans), and a mere \$3.0 million in the smallest market (Milwaukee, with 1.65 million potential fans), in 1999 dollars and based on 1999 population figures (Burger and Walters 2003, p. 119).

When MRPs are affected by market size in this way, there are some interesting implications for the structure of observed wages. For example, if two teams from markets of significantly different size are vying for the services of a particular player, the larger-market team can win the auction by simply bidding a tiny bit more than the player's MRP in the smaller market.[3] Even in a perfect-information world in which all bidders estimate the player's productivity identically and correctly, his wage rate need not equal his MRP in the market in which he ultimately lands unless his salary is the product of bidding between teams in identically-sized markets. Viewed another way, teams lucky enough to inhabit larger markets may earn rents on particular players even if the bidding for their services involves several (smaller) competitors.

More generally, if we rank each team *i* (where *i* = 1, 2, … 30 in major league baseball) according to the value of a marginal win (VMW) in its market, from the smallest to the largest, so that

$$\mathrm{VMW}_{1} < \mathrm{VMW}_{2} < \ldots \mathrm{VMW}_{30}, \tag{1}$$

then each player *j* with marginal productivity MW_j (and, again, we assume a perfect-information world where all teams share identical estimates of a player's likely productivity) will face the following possible array of bids for his services:

[3] Though it should be noted that if employers behave "irrationally"—if, e.g., they are willing to "pay any price to win"—and do not limit their wage offers to players' MRPs in their market, the structure of wages may be markedly different from that described in the foregoing analysis.

$$MW_j(VMW_1) < MW_j(VMW_2) < \ldots < MW_j(VMW_{30}). \quad (2)$$

The wage each player on auction ultimately will receive therefore depends not just on his productivity but on the identities of the teams that choose to bid, their VMWs, and, perhaps, the player's (or his agent's) negotiating skill. In contrast to markets where all employers attach the same marginal value to each unit of output a worker contributes, in this market competitive bidding need not drive employees' wages to equality with their MRPs and with each other. Instead, we can predict only that player *j* will play for the largest-market team that bids for his services[4] and that his wage (W_j) will be bounded by the VMWs of the two largest-market teams that bid for him:

$$MW_j(VMW_i) < W_j \leq MW_j(VMW_{i+1}). \quad (3)$$

Why don't large-market teams bid for and acquire *all* the best talent? The answer involves a combination of technical and institutional constraints on production in the baseball industry. First, of course, only nine players can take the field at any time,[5] and so the marginal productivity of bench-warmers—even high-quality ones—is extremely limited. Second, skills at one position often do not transfer to others. Effectively, then, the production function here involves discontinuities. If, for example, the largest-market team has hired the best first baseman available, it will be uninterested in bidding on the second-best, since he will rarely play at first base and likely be incompetent at other positions, driving his marginal product toward zero. Third, the sport's collective bargaining agreement allows players to auction their services (as "free agents") to all 30 teams only after they have accumulated six years of major league service time, prior to

[4] It is not uncommon, however, for players to sacrifice some monetary income to play in markets pleasing to them for other reasons, e.g., proximity to their hometowns.
[5] Of course, ten players may contribute at one time in the American League, thanks to that league's Designated Hitter rule.

which teams hold a certain amount of monopsony power over them. The degree of monopsony exploitation is greatest during players' first two or three years of service, after which an arbitration system reduces but does not eliminate exploitation (see Marburger 1994; Burger and Walters 2005). So, before bidding on free agents, large-market teams rationally will fill as many positions as possible with low-seniority players on whom they are virtually assured rents.[6] Finally, large-market teams may leave some talent available for their smaller-market rivals in order to ensure that there is enough uncertainty in the outcome of games to keep customers interested in the sport, as Rottenberg (1956) has suggested.

In any event, in this labor market there likely will be significant wage dispersion, and the observed variance in wages will depend not only on variance in worker quality or seniority (given the aforementioned institutional characteristics), but on variance in the size of markets. Individual players' wages will be positively correlated with—but not necessarily equal to—their MRPs in the markets in which they play. As we attempt to explain variation in individual players' wages and test whether they incorporate fairness premia, it will be important to incorporate firm-specific measures of each player's value in our tests.

IV. Two Tests for Fairness Premia

A. The Basic Fair Wage Model

In the literature on fairness and wage determination, it is customary to argue that workers hold beliefs about the level of remuneration that is fair, that their beliefs are

[6] It should be noted also that Coasian sales of high-quality, low-seniority players from small- to large-market teams are prohibited by the sport's Commissioner in order to "preserve competitive balance."

influenced by reference points such as the wages received by others within a firm or industry, and that employers may be willing to pay fairness premia to close gaps between actual wages and those perceived as fair in order to forestall shirking or induce greater cooperation (Akerlof and Yellen 1990; Skott 2005). In some formulations, the presence of a cohort of high-wage workers in a firm or industry is said to produce an "envy" effect in other cohorts (Strom 1995).

In the context of the major league baseball labor market, this literature suggests that, *ceteris paribus*, an individual player's wage may be higher because of the presence on his team of a significant cohort of better-compensated players. Failing to pay a player such a fairness premium—which we are effectively defining as a payment that is independent of the value of his output—risks shirking or uncooperative (i.e., selfish or non-team-oriented) behavior. As noted earlier, baseball data are detailed enough to allow estimation of wage equations suitable for a variety of tests for the presence of such premia. Not only are precise productivity measures available at the individual level (so that we can avoid relying on worker characteristics as proxies for performance, as many studies do), but firm data are available so that we can calculate MRPs for individual players and allow them to vary based on market size. What is more, salary data are sufficiently widely-disseminated that players generally know what their teammates are being paid and can form beliefs about fair wages quite readily.

Accordingly, in this section we estimate wage regressions in which players' salaries depend on (i) precise measures of their marginal productivity and, more importantly, its *value* to their employers, (ii) various individual characteristics that might affect their ability to bargain, and (iii) two alternative measures of their teams' salary structures that might serve as reference points in determining whether payment of fairness premia is necessary. Table 1 lists all variables used, describes their construction and their attributes, and identifies sources of data.

Of central interest are the two reference-point measures *RP1* and *RP2*, which alternatively might be termed "envy indicators." *RP1* equals the ratio of the subject player's team's total payroll to the average team's payroll (so that values greater than one signal above-average levels of compensation paid by the team); *RP2* is a count of the number of highly-paid "star" players—defined as those earning more than 10 times the prevailing minimum salary—on the player's team. A positive coefficient on either of these measures would signal that, all else the same, the presence of a cohort of highly-paid players on one's team exerts an independent effect on one's salary, and would support the idea that observed wages incorporate fairness premia.[7]

<< Insert Table 1 about here >>

As a robustness check, we employ two distinct data samples to estimate these wage regressions. In the next section we analyze a sample of second-year player salaries over the span of a decade. By focusing on all sophomores who received votes in the previous year's "rookie of the year" balloting (and who therefore established themselves as regulars on their teams), we hold constant players' bargaining power, which is seniority-related. Players in their second year of major league service are eligible for neither free agency nor salary arbitration. As a result, any variation in their salaries that is not related to their productivity or its value can be said to result from bargaining between employees and employers rather than the decisions of an arbitrator or some other

[7] An alternative approach suggested by the fairness literature would compare wages to firm profits, but measures of profits are notoriously unreliable in major league baseball, where, for a variety of reasons, team owners have a strong incentive to appear unprofitable (see e.g., Fort (2003, p. 117)).

confounding factor. After considering this special class of players, we then broaden our approach with cross-sectional analysis of all player salaries for a given year.

B. Sophomore Players, 1994-2004

Our sample of 178 second-year players includes all players from 1994-2004 who received at least one "rookie-of-the-year" vote after their initial season of major league service. This sample selection technique allows us to focus on players that likely were expected by their teams to be significant contributors as sophomores. Salaries for players in their first three years of service (pre-arbitration eligibility) are greatly influenced by the minimum salary set by the collective bargaining agreement. Our empirical investigation must therefore take account of the fact that between 1994 and 2005 the minimum salary increased from \$109,000 to \$316,000. In order to ensure that the dependent variable in our wage regressions is stationary, we calculate the ratio of the player's sophomore salary to the minimum salary for that year (each converted into 1999 dollars), labeled *WRATIO*. By construction this salary ratio is bounded from below at one; therefore we use the maximum likelihood method to estimate a Tobit[8] for the following specifications:

$$WRATIO_{t+1} = \alpha + \beta_1 RP1 + \beta_2 Contract + \beta_3 MP_t + \varepsilon, \tag{4}$$

$$WRATIO_{t+1} = \alpha + \beta_1 RP2 + \beta_2 Contract + \beta_3 MP_t + \varepsilon, \tag{5}$$

$$WRATIO_{t+1} = \alpha + \beta_1 RP1 + \beta_2 Contract + \beta_3 MRP_t + \varepsilon, \tag{6}$$

$$WRATIO_{t+1} = \alpha + \beta_1 RP2 + \beta_2 Contract + \beta_3 MRP_t + \varepsilon, \tag{7}$$

[8] As it turns out, our results are identical to OLS because there was not a single sophomore player who was paid exactly the minimum salary. This indicates that while teams hold considerable monopsony power over pre-arbitration-eligible players, they either (a) bump wages above the minimum for fairness reasons or (b) pay players a share of their MRP as a result of bargaining by the players or their agents. These regressions resolve that question.

where t denotes variables from the player's rookie season and t+1 from his sophomore season; *RP1* and *RP2* are alternative reference points or "envy indicators," described in Table 1, *Contract* is a dummy variable controlling for players who received major league contracts at their initial signing (as is often the case for players migrating from the Japanese professional leagues and, less often, for highly-sought amateurs), *MP* is the player's marginal physical productivity, and *MRP* his marginal revenue product.

Specifications (4) and (5) investigate whether the sophomore salary ratio appears to be influenced by fairness concerns after controlling just for the physical productivity of the player. For a concise, state-of-the-art measure of players' overall contribution to their teams' output of wins we rely on the research of James (2002), who has developed a method of translating all the various forms of output by hitters, fielders, and pitchers into a single statistic called Win Shares.[9] This measure of physical output can be easily combined with the Burger and Walters (2003) estimates of the value of marginal wins (VMWs) to calculate MRPs for individual players, used in specifcations (6) and (7).

<< Insert Table 2 about here >>

The first two columns of Table 2 contain evidence in support of the fair wage model. In each case the coefficients for the reference points are positive and statistically significant, suggesting that teams with higher-than-average payrolls (*RP1*) and/or a large number of highly paid players (*RP2*) pay more for players of a given ability. In the next two specifications, however, we take the test a step further and control not just for a player's physical productivity but for its value; our calculation of players' MRPs allows

[9] James is a founding father of the field of "sabermetrics," or the application of statistical methods to the study of baseball. His tools for evaluating individual player productivity are widely used by researchers, journalists, and teams themselves. The central virtue of the Win Shares measure is that it ignores no element of player performance that can have an effect on team success; in that regard, it is far superior to less sophisticated methods of measuring productivity sometimes used in the sports economics literature (see, e.g., Scully (1974)).

for the fact that a given amount of physical productivity will be worth more to larger-market employers. The results indicate that once we control for MRP, neither reference point (or envy indicator) exerts a statistically significant impact on wages. In sum, in this sample *we find no support for fair wage theory once we properly control for the value of players' output* in our wage regressions.

Given the well documented relationship between market size and team payrolls, one might be concerned with the possibility of multicollinearity driving the results in Table 2. In fact there is a positive correlation between our reference point variables and *MRP*, but these correlations are relatively modest at 0.422 (for *RP1*) and 0.361 (*RP2*). More importantly, if collinearity were the culprit we would observe a substantial increase in the standard errors for the estimated coefficients on *RP1* and *RP2* in specifications (6) and (7).[10] To the contrary, these coefficients do not become statistically insignificant because of imprecise estimates; rather, introduction of the *MRP* measure dramatically decreases the *size* of the coefficients on these indicators.

Thus, the results in Table 2 suggest that controlling for worker productivity alone in wage studies—as is often done, either because of unavailability of data or a deep-seated belief that the value of output is invariant across employers—may not be sufficient to properly test fair wage models. Evidently, failing to measure workers' MRPs reasonably accurately in wage regressions can introduce substantial bias into estimated coefficients; in this case, that bias creates an illusion that high-payroll or star-laden teams pay fairness premia to their lower-paid, second-year players. Once specifications include accurate measures of players' MRPs, however, there is no longer evidence that fairness considerations have a significant effect on player salaries.

[10] See Griffiths, Hill and Judge (1993, p. 435).

C. A Cross-Section of All Players, 2003

We next test whether these results carry over to a much larger and diverse sample of players, including those with a wide range of experience and bargaining power—i.e., pre-arbitration players, arbitration-eligible players, and free agents. As a rough control for both experience and bargaining power, we include the player's age and age squared as explanatory variables in these cross-sectional regressions:

$$W_t = \alpha + \beta_1 RP1 + \beta_2 Age_t + \beta_3 Age_t^2 + \beta_4 MP_t + \varepsilon, \qquad (8)$$

$$W_t = \alpha + \beta_1 RP2 + \beta_2 Age_t + \beta_3 Age_t^2 + \beta_4 MP_t + \varepsilon, \qquad (9)$$

$$W_t = \alpha + \beta_1 RP1 + \beta_2 Age_t + \beta_3 Age_t^2 + \beta_4 MRP_t + \varepsilon, \qquad (10)$$

$$W_t = \alpha + \beta_1 RP2 + \beta_2 Age_t + \beta_3 Age_t^2 + \beta_4 MRP_t + \varepsilon, \qquad (11)$$

There are 608 usable observations in the 2003 sample after removing players who played for multiple teams, for whom salary information was unavailable, or whose playing time was limited (i.e., less than 100 at-bats or 30 innings pitched). Player salary is the dependent variable in specifications (8) - (11); unlike the second-year player cohort, there is no need to form a stationary ratio in these cross-sectional regressions. The level of the dependent variable (salary) is censored from below at the minimum salary ($300k in 2003); therefore, we again employ Tobit estimation.[11]

Maximum likelihood results for specifications (8) and (9), presented in Table 3, mirror those reported for the sophomore class in Table 2. Players appear to receive an envy-induced fairness premium when one simply controls for their physical output: the coefficients on *RP1* and *RP2* are both positive and highly significant. Once again, however, this premium evaporates when we replace *MP* with *MRP* in specifications (10)

[11] Results from regressions on the natural log of salary follow the same pattern of the results reported in Table 3.

and (11). The positive impact of experience and bargaining power on player salaries is seen in the positive and significant coefficient on *Age*; the negative coefficient on Age^2 reflects diminishing returns to experience.

<< Insert Table 3 about here >>

In sum, both tests performed in this section fail to reject the null hypothesis that *fairness considerations have no effect on wages when a player's value to his team is held constant*. In addition, the results reported in Tables 2 and 3 suggest that a fairness test which controls only for the physical productivity of the worker (or, one step removed from that, worker characteristics) but not the marginal value of the worker's output may be misleading. For major league baseball we find a wage structure that appears on the surface to be affected by fairness but that in reality reflects market-size-sensitive marginal revenue products. In the concluding discussion we consider whether or not this result is specific to baseball.

V. Summary and Concluding Remarks

While it is common to suppose that "anomalous" wage differentials across and within industries may result from fairness considerations, the tests presented here challenge this view. In this study we have avoided using proxies for the value of individual workers' output by focusing on the baseball labor market, where data on individual performance and compensation are unusually detailed and precise. We find that, while it is possible to infer that fairness considerations affect wages when individual employees' physical productivity is held constant, this is an illusion resulting from the failure to recognize firm-specific differences in the value of output. Once individual employees' MRPs are held fixed, we find no support for fair wage theory in this market. This raises a provocative question: Is this finding limited to baseball or do individual-specific MRPs have broader power to explain intra- and inter-industry wage differentials?

Variation in workers' MRPs will originate in either of two sources: variance in workers' *physical productivity*, and/or variance in the *value* of their output. Yet consideration of these simple possibilities generally has not been emphasized in prior studies of wage differentials for two reasons. First, neoclassical labor theory has conditioned us to assume that MRPs won't vary across firms or industries, for if they did firms would hire more (less) labor until its MRP fell (rose) to the level of the market wage. In baseball, of course, we directly observe constraints (the roster limits and position-specific skills discussed in section III) that create discontinuities in each firm's production function, but it simply is not customary to think that such discontinuities, and resulting MRP inequalities, are common elsewhere. Second, the data are often problematic. The available data commonly involve large panels covering many occupations, firms, and industries, making measurement of workers' marginal productivity at the individual level—much less the value of their individual output—simply impossible. As a result, we have tended to focus on proxies such as workers' characteristics (and debated the role of unobserved characteristics) in explaining wage differentials. Nevertheless, researchers have unearthed several findings that are quite consistent with MRP-based explanations for "anomalies" in the structure of wages.

Perhaps the closest proxy for workers' MRPs was provided in one of the earliest inter-industry wage studies. Slichter (1950) found a very strong rank correlation (0.93) between industries with high value added per worker-hour and those with high wages; he proposed a rent-sharing explanation for his findings but the results are also consistent with MRP variation across industries. Although his value-added measure is an average, Slichter noted “it is quite possible that there is a tendency for the average value added to be high where marginal value added is high” (p. 87).

The literature on industry- or size-related wage premia also contains some findings consistent with market-size-related variance in MRPs. For example, in the fairness literature the fact that such wage premia are associated with reduced turnover (Krueger and Summers 1988) and lower quit rates (Brown and Medoff 1989) has been interpreted as evidence that workers consider their wages to be in excess of their (uniform) opportunity costs. But if MRPs vary across or within industries (e.g., rising with firm size), we will observe the same result: workers are less likely to quit a job where their MRP is relatively high because they know they may have to take an alternative position where their MRP, and wage, is lower.

Evidence of size-related variation in MRP is provided by Idson and Oi (1999), who found that manufacturing labor is significantly more productive in larger plants, and who argued that wages rise with firm size because physical productivity does so for both service- and goods-producing industries. They offered a host of reasons why this is so, from higher customer arrival rates and greater safety at larger workplaces (so that employee idle-time is minimized) to greater capital intensity resulting from lower capital costs. Consistent with our results, Idson and Oi found that once productivity is controlled for the firm size-wage anomaly disappears.

The literature on urban agglomeration has also uncovered some regularities that are consistent with MRP-based explanations for wage differentials. Glaeser and Mare

(2001) demonstrated that, all else equal, workers in metropolitan areas receive wage premia, while Ciccone and Hall (1996) found a positive relationship between labor productivity and the density of economic activity. Urban models posit explanations that include information externalities, reduced transaction costs, more extensive division of labor, economies of scale, and improved worker-firm matching. Each of these theories suggests that the physical productivity of labor increases in dense markets, implying a higher MRP for workers in urban settings. The lessons from the baseball labor market may be particularly appropriate in this literature. While existing urban models emphasize variation in physical productivity as an explanation for wage premia, it seems plausible that a density or market-size effect on the marginal *value* of workers' output—analogous to that for large-market baseball teams—may also be present.

In sum, we believe that the baseball labor market holds some important lessons for those seeking to understand wage differentials. We do not doubt that fair wage models or other theories advanced to explain apparent anomalies in labor markets can enhance understanding of employer and employee behavior. We do wonder, however, whether properly measuring the value of individual workers' output in studies of the structure of wages will lead to a significant reduction in the number of anomalies such theories need to explain.

References

Abowd, John M., Francis Kramarz, and David N. Margolis. 1999. High-wage workers and high-wage firms. *Econometrica* 67, no. 2:251-334.

Akerlof, George A., and Janet L. Yellen. 1990. The Fair Wage-Effort Hypothesis and Unemployment. *Quarterly Journal of Economics* 105, no. 2:255-83.

Arai, Mahmood. 2003. Wages, Profits, and Capital Intensity: Evidence from Matched Worker-Firm Data. *Journal of Labor Economics* 21, no. 3:593-618.

Blackburn, McKinley, and David Neumark. 1992. Unobserved Ability, Efficiency Wages, and Interindustry Wage Differentials. *Quarterly Journal of Economics* 107, no. 4:1421-36.

Blanchflower, David G., Andrew J. Oswald, and Peter Sanfey. 1996. Wages, Profits, and Rent-Sharing. *Quarterly Journal of Economics* 111, no. 1:227-51.

Blinder, Alan S., and Don H. Choi. 1990. A Shred of Evidence on Theories of Wage Stickiness. *Quarterly Journal of Economics* 105, no. 4:1003-15.

Brown, Charles, and James Medoff. 1989. The Employer Size-Wage Effect. *Journal of Political Economy* 97, no. 5:1027-59.

Burger, John D., and Stephen J.K. Walters. 2003. Market Size, Pay, and Performance: A General Model and Application to Major League Baseball. *Journal of Sports Economics* 4, no. 2:108-25.

__________. 2005. Arbitrator Bias and Self-Interest: Lessons from the Baseball Labor Market. *Journal of Labor Research* 26, no. 2:267-80.

Ciccone, Antonio, and Robert E. Hall. Productivity and the Density of Economic Activity. *American Economic Review* 86, no. 1:54-70.

Dickens, William T. 1986. Wages, Employment and the Threat of Collective Action by Workers. NBER Working Paper No. 1856, National Bureau of Economic Research, Cambridge, MA.

Dickens, William T., and Lawrence F. Katz. 1987. Inter-industry Wage Differences and Industry Characteristics. In *Unemployment and the structure of labor markets*, ed. Kevin Lang and Jonathan Leonard, 48-89. New York: Blackwell.

Fehr, Ernst, George Kirchsteiger, and Arno Riedl. 1993. Does Fairness Prevent Market Clearing? An Experimental Investigation. *Quarterly Journal of Economics* 108, no. 2:437-59.

Fort, Rodney D. 2003. *Sports economics*. Upper Saddle River, NJ: Prentice-Hall.

Gibbons, Robert, and Lawrence F. Katz. 1992. Does Unmeasured Ability Explain Inter-industry Wage Differentials? *Review of Economic Studies* 59, no. 3:515-35.

Glaeser, Edward L., and David C. Mare. 2001. Cities and Skills. *Journal of Labor Economics* 19, no. 2:316-42.

Griffiths, William E., R. Carter Hill, and George G. Judge. 1993. *Learning and practicing econometrics*. New York: John Wiley & Sons.

Idson, Todd L., and Walter Y. Oi. 1999. Workers Are More Productive in Large Firms. *American Economic Review* 89, no. 2:104-08.

James, Bill. 2002. *Win shares*. Morton Grove, IL: STATS, Inc.

Kahneman, Daniel, Jack L. Knetsch, and Richard Thaler. 1986. Fairness as a Constraint on Profit Seeking: Entitlements in the Market. *American Economic Review* 76, no. 4:728-41.

Krueger, Alan B., and Lawrence H. Summers. 1988. Efficiency Wages and the Inter-industry Wage Structure. *Econometrica* 56, no. 2:259-93.

Lallemand, Thierry, Robert Plasman, and Francois Rycx. 2004. Intra-firm Wage Dispersion and Firm Performance: Evidence from Linked Employer-Employee Data. *Kyklos* 57, no. 4:533-58.

Lawler, Edward E., and Paul W. O'Gara. 1967. The Effects of Inequity Produced by Underpayment on Work Output, Work Quality and Attitudes toward the Work. *Journal of Applied Psychology* 51, no. 5:403-10.

Levin, Richard C., George J. Mitchell, Paul A. Volcker, and George F. Will. 2000. *The report of the independent members of the Commissioner's Blue Ribbon Panel on Baseball Economics*. New York: Major League Baseball.

__________. 2001. *MLB updated supplement*. New York: Major League Baseball.

Marburger, Daniel R. 1994. Bargaining Power and the Structure of Salaries in Major League Baseball. *Managerial and Decision Economics* 15, no. 5:433-41.

Moore, Henry L. 1911. *Laws of wages: An essay in statistical economics*. New York: Augustus M. Kelley.

Murphy, Kevin M., and Robert H. Topel. 1987. Unemployment, Risk, and Earnings: Testing for Equalizing Wage Differences in the Labor Market. In *Unemployment and the structure of labor markets*, ed. Kevin Lang and Jonathan Leonard, 103-40. New York: Blackwell.

Oi, Walter Y. 1983. Heterogeneous Firms and the Organization of Production. *Economic Inquiry* 21, no. 2:147-71.

Oi, Walter Y., and Todd L. Idson, Todd L. 1999. Firm Size and Wages. In *Handbook of labor economics*, 3rd Ed., ed. Orley Ashenfelter and David Card, 2165-2214. Amsterdam: Elsevier Science.

Pritchard, Robert D., Marvin D. Dunnette, and Dale O. Jorgenson. 1972. Effects of Perceptions of Equity and Inequity on Worker Performance and Satisfaction. *Journal of Applied Psychology Monograph* 56, no. 1:75-94.

Rees, Albert. 1993. The Role of Fairness in Wage Determination. *Journal of Labor Economics* 11, no. 1:243-52.

Rosen, Sherwin. 1986. The Theory of Equalizing Differences. In *Handbook of labor economics*, ed. Orley Ashenfelter and Richard Layard, 641-92. Amsterdam: Elsevier Science.

Rottenberg, Simon. 1956. The Baseball Player's Labor Market. *Journal of Political Economy* 64, no. 2:243-56.

Salop, Steven C. 1979. A Model of the Natural Rate of Unemployment. *American Economic Review* 69, no. 1:117-25.

Schmitt, David R., and Gerald Marwell. 1972. Withdrawal and Reward Allocation as Responses to Inequity. *Journal of Experimental Social Psychology* 8, no. 3:207-21.

Scully, Gerald W. 1974. Pay and Performance in Major League Baseball. *American Economic Review* 64, no. 6:915-30.

Shapiro, Carl, and Joseph E. Stiglitz. 1984. Equilibrium Unemployment as a Worker Discipline Device. *American Economic Review* 74, no. 3:433-44.

Shippen, Ben S., Jr. 1999. Unmeasured Skills in Inter-industry Wage Differentials: Evidence from the Apparel Industry. *Journal of Labor Research* 20, no. 1:161-69.

Skott, Peter. 2005. Fairness as a Source of Hysteresis in Employment and Relative Wages. *Journal of Economic Behavior and Organization* 57, no. 3:305-31.

Slichter, Sumner. 1950. Notes on the Structure of Wages. *Review of Economics and Statistics* 32, no. 1:80-91.

Sommers, Paul M., and Noel Quinton. 1982. Pay and Performance in Major League Baseball: The Case of the First Family of Free Agents. *Journal of Human Resources* 17, no. 3:426-36.

Strom, Bjarne. 1995. Envy, Fairness and Political Influence in Local Government Wage Determination: Evidence from Norway. *Economica* 62, no. 247:389-409.

Thaler, Richard H. 1992. *The Winner's Curse: Paradoxes and Anomalies of Economic Life*. New York: The Free Press.

Valenzi, Enzo R., and I. Robert Andrews. 1971. Effects of Hourly Overpay and Underpay Inequity When Tested with a New Induction Procedure. *Journal of Applied Psychology* 55, no. 1:22-27.

Weiss, Andrew W. 1980. Job Queues and Layoffs in Labor Markets with Flexible Wages. *Journal of Political Economy* 88, no. :526-38.

Table 1 – Variables Used in Wage Regressions and Data Sources

Variable Label	Variable Description	Method of Calculation (Units)	Data Sources
	Dependent Variables:		
$WRATIO_{t+1}$	Ratio of player's wage in year t+1 to the minimum allowable wage in that year	Player's reported wage/minimum allowable	baseball-reference.com
W_t	Player's wage in year t	(millions of real 1999 dollars)	baseballgraphs.com/2003
	Independent Variables:		
	(i) Productivity		
MP_t	Player's marginal productivity above that of an available replacement-quality player in year t	Win Shares/3, since Win Shares are reported as thirds of a team win (wins)	James (2002); baseballgraphs.com/2003
MRP_t	Player's market-specific marginal revenue product in year t	MP_t x market-specific marginal revenue per win (millions of real 1999 dollars)	Burger and Walters (2003)
	(ii) Controls		
Contract	Dummy variable, = 1 if player received a major-league contract at initial signing	(0, 1)	baseball-reference.com
Age_t	Player's age in year t	(years)	baseball-reference.com
	(iii) Reference points		
RP1	"Envy indicator" equal to ratio of player's team's total payroll to industry average payroll	Total team payroll/average in that year	baseball-reference.com; rodneyfort.com/SportsData
RP2	"Envy indicator" equal to number of superstar-level salaries on player's team	Count of players on team paid > ten times minimum salary	baseball-reference.com; rodneyfort.com/SportsData

Table 2 – Tobit Regression Results, MLB Second-Year Player Salaries, 1994-2004

Explan. Variable / Equation:	(4)	(5)	(6)	(7)
RP1	1.012** (0.448)		0.379 (0.480)	
RP2		0.094** (0.048)		0.039 (0.050)
Contract	7.319*** (0.580)	7.405*** (0.570)	7.327*** (0.569)	7.335*** (0.567)
MP	0.106*** (0.035)	0.105*** (0.035)		
MRP			0.135*** (0.041)	0.137*** (0.040)
No. of Observations	178	178	178	178

Notes: Dependent variable is *WRATIO*, the ratio of the player's second-year salary to the league minimum (each in 1999 dollars). Standard Errors are in parentheses; *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3 – Tobit Regression Results, Cross Section of 2003 MLB Salaries

Explan. Variable \ Equation:	(8)	(9)	(10)	(11)
RP1	1.397*** (0.298)		0.054 (0.342)	
RP2		0.138*** (0.037)		0.005 (0.040)
Age	1.054*** (0.292)	1.045*** (0.294)	1.043*** (0.299)	1.043*** (0.299)
Age^2	-0.013*** (0.005)	-0.013*** (0.005)	-0.013*** (0.005)	-0.013*** (0.005)
MP	0.191*** (0.014)	0.194*** (0.014)		
MRP			0.287*** (0.024)	0.288*** (0.023)
No. of Observations	608	608	608	608

Notes: Dependent variable is *W*, player salary in millions of real (1999) dollars. Standard Errors are in parentheses; *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.