The Measurement of Racial Discrimination in Pay Between Job Categories: Theory and Test*

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Abstract: The traditional model of taste discrimination in pay treats majority and minority workers as perfect substitutes. Consequently, the model is only appropriate for measuring majority/minority differences in pay for workers performing the same job assignment. In this study, the traditional model is extended to allow for the measurement of racial pay differences between majority workers performing a job different from the one performed by minority workers. We model an employer who hires workers for two complementary jobs. However, due to human capital and labor supply differences, majority workers are only suitable for job A, whereas minority workers are only suitable for job B. We extend Becker's *Market Discrimination Coefficient* to allow for the measurement of racial discrimination between job assignments, first under perfect competition and then under pure monopsony. We find that discrimination can vary in counterintuitive ways depending upon the structure of the labor market and group differences in productivity and labor supply. The model is tested using data on Major League Baseball hitters and pitchers for four different seasons during the 1990s, a period during which the Major League expanded in size. We test the perfect competition version of the model on free agents and players eligible for arbitration, whereas the monopsony version is tested on younger players subject to the reserve clause. We find strong evidence of *ceteris paribus* racial wage differences between hitters and pitchers.

We thank Bree Dority O'Callaghan for assistance with the data collection, as well as Lawrence Kahn, Wing Suen, William Boal and Ted To for comments on earlier drafts. We bear full responsibility for any errors or omissions.

Theme: Discrimination
Key Words: Wage Discrimination, Complementarity, Monopsony Power
JEL-Code: J7

I. Introduction

In 2006, according to the Bureau of Labor Statistics the median weekly earnings of male and female elementary and middle school teachers were $920 and $824, respectively, whereas for male and female school principals and school district superintendents, median weekly earnings were $1,275 and $1,107, respectively. During the same year, the median weekly earnings of male and female registered nurses were $1,074 and $971, respectively, whereas for male and female physicians and surgeons they were $1,847 and $1,329, respectively. Median weekly earnings of male and female lawyers were $1,891 and $1,333, respectively, whereas for female legal assistants, they were $726 (data on earnings of male legal assistants are not available). Male and female cooks earned $377 and $340, respectively, whereas male and female restaurant waitpersons earned $284 and $348, respectively. Finally, during 2006 the median weekly earnings of male aircraft pilots and flight engineers were $1,419, whereas for female flight attendants, median weekly earnings were $488 (data on male flight attendant earnings are not available).[1]

What do the above examples have in common? First, each example involves a pair of job assignments within a firm that are distinctly *complementary*; Pilots and flight attendants are complementary labor inputs in the production of airline service, educational administrators and teachers are complementary in the provision of educational services, physicians and nurses complement one another in the provision of health care services, etc. Second, in each example for which data on earnings of each gender are available, there are noticeable gender pay gaps within each job assignment -- 9% for school teachers, 20% for principals and superintendents, nearly 10% for registered nurses, 28% for physicians and surgeons, nearly 30% for lawyers, 10% for cooks and 22.5% for waitpersons (in favor of females, however). A commonly asked question would be: How much of these *intra-job* gender pay gaps are attributable to discrimination? This is the approach taken in the traditional wage discrimination model, due originally to Becker (1971) and Arrow (1972). This model is based on the fundamental assumption that majority and minority workers are perfect substitutes in production. Consequently, the traditional model is only appropriate for studying gender or racial pay differences for workers performing the same job assignment.

In this paper, we ask a different question: To what extent is the majority/minority pay gap *across* complementary job assignments in the firm attributable to discrimination? For example, how much of the $931 (65.6%) pay gap between male aircraft pilots and flight engineers and female transportation attendants, the $1,165 pay gap between male lawyers and female legal assistants and the $876 pay gap between male physicians and surgeons and female registered nurses, attributable to discrimination? Are these gaps primarily attributable to majority/minority productivity differences or to prejudice? This is a question about *inter- job* wage discrimination and it is a far more difficult question because to answer it we need to compare majority and minority workers for which there will be both distinct productivity and labor supply differences. In the traditional (within-job assignment) model of wage discrimination, details of the production function are dispensed with because there are no productivity and labor supply differences between workers. However, in a study of discrimination across job assignments, the production and labor supply functions must be given explicit consideration.

While most of the discrimination literature focuses on the measurement of the majority/minority pay gap within the same job category, some early literature provides hints on how the traditional model could be extended to account for discriminatory pay gaps across job categories. Becker (1971, pp. 59-62) briefly sketched an extension of his two-factor Black/White worker model to a three-factor model. Two of the factors are perfectly substitutable Blacks and Whites that belong to a group that could be called “Type 1 Labor.” Then, there is a third labor input, “Type 2 Labor,” that discriminates against Blacks and is complementary to or imperfectly substitutable for them. Type 2 workers could, for example, be managers. In this situation, Becker showed that there will be a *ceteris paribus* Black/White wage gap within the Type 1 category. Arrow (1972) elaborated on this by showing that the Black/White wage gap depends upon the sensitivity of Type 2 labor’s reservation wage to the fraction of the firm’s labor force that is Black, as well as the importance of

Type 2 labor as an input (importance is measured as the size of the payments to Type 2 labor relative to Type 1 labor). Neither Becker nor Arrow tested these propositions, nor did they investigate further the implications of complementarity in production for the Black/White pay differential.

Welch (1967) suggested the possibility that Blacks and Whites working in the same firm may not be perfect substitutes because there may be differences in their educational endowments. Welch argued that, for example, perhaps because of long term discrimination, Blacks may have acquired less schooling and/or attended lower quality schools. He modeled educational endowments and physical labor as separate factors of production, allowing for racial differences in educational endowments and, following Becker and Arrow, White coworker discrimination. He argued that if firms choose racially integrated labor forces, then Blacks and Whites must be complementary inputs. The intuition is that because of Whites' aversion to working with Blacks, integration creates inefficiencies that will cause joint product to be less than the sum of individual Black and White worker marginal products. The firm will only integrate its labor force if there are sufficiently large complementarities to be exploited, i.e. if the gains from complementarity exceed the losses attributable to coworker discrimination.

The work of Becker, Arrow and Welch was followed by a very large empirical literature on wage discrimination during the 1970s, all based on the original Becker model of perfect substitution. The empirical evidence was called into question beginning in the early 1980s, when a number of studies provided evidence that racial, as well as ethnic, groups in the U.S. economy are not perfectly substitutable. These studies typically applied econometric models of Translog or Generalized Leontief aggregate production functions to mostly U.S. census data to estimate elasticities of complementarity between groups. For example, Grant and Hamermesh (1981) found that Black adults were substitutes for White men and complements to White women and youths in production. Borjas (1983) showed evidence suggesting that Black male workers might be substitutes for White male workers, but that Hispanic and White male workers are complementary.

In a later study, Borjas (1987) showed Black natives were substitutes for White natives. Very recently, Kahanec (2006) employed the same methodology on U.S. census data to provide evidence that non-White labor is complementary to White labor. Although these studies do not examine wage discrimination, they do establish an important empirical link between the traditional wage discrimination model and the production function.

In this paper, we seek to build upon the work of Becker, Arrow and Welch, as well as upon the empirical studies on the substitutability of racial and ethnic groups, by developing and testing a theoretical model of pay discrimination across job assignments. In contrast to Becker, Arrow and Welch, we consider the influence of customer discrimination against non-White labor in a firm which employs complementary White and non-White labor groups that are segregated across job assignments. We derive expressions for the *ceteris paribus* racial pay gap when the labor market is perfectly competitive and when there is pure monopsony. The model is then tested on an industry characterized by complementary job assignments, racial integration, variation in monopsony power across worker groups and a past history of racial discrimination – Major League Baseball.

Our study establishes important theoretical and empirical links between the firm's production function and the traditional Becker/Arrow wage discrimination model. We argue that a study of discrimination across job assignments must be based on explicit consideration of the production function. In previous literature, there is no formal theory of *ceteris paribus* racial or gender differences in pay across job assignments. Furthermore, the empirical approach usually taken to the study of differences in pay across job assignments has simply been to include occupation or industry dummies in traditional wage regressions. In this study, we develop a theory of wage discrimination across job assignments and show that it implies a much more substantive empirical strategy. This study is related to one by Bodvarsson and Partridge (2001), who tested an original theoretical model of racial wage discrimination in the National Basketball Association. They used a quadratic production function where White and non-White players are imperfect substitutes, but they did not test for racial discrimination across player job assignments.

II. A Model of Wage Discrimination Across Job Assignments

We extend the Becker/Arrow wage discrimination model to the case where there are productivity differences between majority and minority workers and minority workers are subject to prejudice. Productivity differences occur because the worker groups are segregated across job assignments, where each group supplies different skills and performs different tasks within the firm. The goal of the analysis is to derive a general equilibrium measure of pay discrimination across assignments. We derive and analyze this measure under two types of labor market structure: perfect competition and pure monopsony.

Perfect Competition

Suppose a firm is perfectly competitive in both the product and labor markets. Production requires the services of workers from two different job categories, where the services provided by workers in one category complement the services provided by workers in the other. For example, workers in job category X assemble the good and those in category Y market it. We use a Cobb-Douglas production function to describe the relationship in production between the two job assignments performed:

(1) $Q = AM^{\alpha}N^{\beta}$

where Q is output, M is the quantity of labor service in one job assignment and N is the quantity of labor service in the other assignment. Other inputs are fixed, so it is assumed that $\alpha + \beta < 1$.

Suppose there is complete segregation by race between job assignments and the segregation is exogenously determined.[2] For example, suppose that only White workers are available to assemble the good, whilst only non-White workers are available to do the marketing. Think of M, therefore, as the quantity of *majority* labor services and N as the quantity of *minority* labor services used in production. Furthermore, customers are prejudiced against minority workers. Customer prejudice may be viewed as a situation where customers discount the marginal revenue product (MRP) of minority workers and may be incorporated into the model through a relatively minor adjustment of the production function. We discount the minority share parameter by a fraction D, such that the production function is now

(2) $Q = AM^{\alpha}N^{\beta D}$.

The lower is D, the more intense the prejudice and the lower is minority MRP. If D equals 1, the case of no prejudice, the production function reverts to equation (1). While it is traditional to think of customer discrimination as implying a price discount on the product of minority occupation workers, the approach above is equivalent: The parameter D reflects the idea that minority output is valued less when customers are prejudiced compared to the case where customers are not prejudiced.[3]

Define W_M (W_N) as the market price of one unit of majority (minority) labor services. With p as product price, the employer's profits π are thus

(3) $\pi = pAM^{\alpha}N^{\beta D} - W_M M - W_N N$

First and second order conditions yield the following demand functions for majority and minority labor services, respectively:

(4) $$M = (\frac{\beta D}{W_N})^{\frac{\beta D}{\gamma}} (\frac{\alpha}{W_M})^{\frac{1-\beta D}{\gamma}} (pA)^{\frac{1}{\gamma}}$$

(5) $$N = (\frac{\beta D}{W_N})^{\frac{1-\alpha}{\gamma}} (\frac{\alpha}{W_M})^{\frac{\alpha}{\gamma}} (pA)^{\frac{1}{\gamma}}$$

where $\gamma = 1-\alpha-\beta D$. One important prediction from equations (4) and (5) is that an increase in customer prejudice (a reduction in D) will result in lower hiring of workers in both job categories ($\partial M/\partial D > 0$, $\partial N/\partial D > 0$).[4] When customers become more prejudiced, this lowers the MRP of minority labor service and reduces its level of usage. Essentially, increased prejudice has the same effect on employment as a reduction in minority marginal product since a lower value of D reduces the minority share parameter (β). The employer responds not by increasing majority labor services, but rather by cutting the usage of *both* inputs; Since both occupations are complementary, less quantity of majority labor service is needed when the usage of minority labor service falls.

On the supply side of the labor market, we assume upward sloping market supply curves for labor services in each job assignment. The labor supply curve equations are, respectively,

(6) $W_M = \varepsilon\theta_M$

(7) $W_N = \lambda\theta_N$

where θ_M and θ_N are the market supplies of the services of majority and minority workers, respectively, and $\varepsilon, \lambda > 0$.

The goal of our analysis is to derive a version of Becker's *Market Discrimination Coefficient* (MDC) that is an outcome of general equilibrium and the unique production conditions described here. The MDC derived here measures the *ceteris paribus* racial (or gender) gap between the two job assignments, i.e. the *ceteris paribus* earnings difference between Whites (or men) in one assignment and non-Whites (or women) in another assignment. The MDC is in its most general form:[5]

(8) $$MDC = \frac{W_M(D<1)}{W_N(D<1)} - \frac{W_M(D=1)}{W_N(D=1)}$$

The first term on the right side of (8) is the occupational wage ratio with customer prejudice, whereas the second term is the ratio in the absence of prejudice. The difference between the two ratios measures the *ceteris paribus* racial or gender pay gap across occupations.

The first step in the derivation of a general equilibrium MDC is the derivation of the partial equilibrium wages for majority and minority labor. Suppose there are F employers. When the majority job category worker market is in equilibrium, $FM = \theta_M$, and when the minority category worker market is in equilibrium, $FN = \theta_N$. We note from equation (6) that

(9) $$\theta_M = \frac{W_M}{\varepsilon}$$

Now multiply equation (4) by F, set this equal to equation (9) and solve for the partial equilibrium majority wage:

$$(10) \qquad W_M = \left[\varepsilon F(\frac{\beta D}{W_N})^{\frac{\beta D}{\gamma}} (pA)^{\frac{1}{\gamma}} (\alpha)^{\frac{1-\beta D}{\gamma}} \right]^{\frac{1}{1+\frac{1-\beta D}{\gamma}}}$$

From equation (7),

$$(11) \qquad \theta_N = \frac{W_N}{\lambda}$$

Now multiply equation (5) by F, set this equal to equation (11) and solve for the partial equilibrium minority wage:

$$(12) \qquad W_N = \left[\lambda F(\frac{\alpha}{W_M})^{\frac{\alpha}{\gamma}} (pA)^{\frac{1}{\gamma}} (\beta D)^{\frac{1-\alpha}{\gamma}} \right]^{\frac{1}{1+\frac{1-\alpha}{\gamma}}}$$

To obtain a general equilibrium (closed form) expression for the majority wage, we substitute expression (12) for W_N in expression (10) and solve again for W_M:

$$(13) \qquad W_M = \left(\frac{Z}{\alpha^{\theta}} \right)^{\frac{1}{1-\theta}}$$

where:

$$(13a) \qquad Z = \left[\varepsilon F(\frac{\beta D}{[(\lambda F(PA)^{\frac{1}{\gamma}} (\beta D)^{\frac{1-\alpha}{\gamma}})]^{\frac{\gamma}{\gamma+1-\alpha}}})^{\frac{\beta D}{\gamma}} (PA)^{\frac{1}{\gamma}} (\alpha)^{\frac{1-\beta D}{\gamma}} \right]^{\frac{\gamma}{\gamma+1-\beta D}}$$

and

$$(13b) \qquad \theta = \left(\frac{\alpha}{\gamma+1-\alpha} \right) \left(\frac{\beta D}{\gamma+1-\beta D} \right)$$

To obtain the general equilibrium minority wage, substitute expression (10) for W_M in expression (12) and solve again for W_N:

$$(14a) \quad W_N = \left[\frac{X}{(\beta D)^{\theta}} \right]^{\frac{1}{1-\theta}}$$

where:

$$(14b) \quad X = \left[\lambda F\left(\frac{\alpha}{\left[(\varepsilon F (PA)^{\frac{1}{\gamma}} (\alpha)^{\frac{1-\beta D}{\gamma}}) \right]^{\frac{\gamma}{\gamma+1-\beta D}}} \right)^{\frac{\alpha}{\gamma}} (PA)^{\frac{1}{\gamma}} (\alpha)^{\frac{1-\alpha}{\gamma}} \right]^{\frac{\gamma}{\gamma+1-\alpha}}$$

In general equilibrium minority and majority wages depend upon the strength of customer demand for the product (p), the size of the industry (F), the intensity of customer prejudice against minority labor (D), the wage elasticities of labor supply (reflected in the values of ε and λ), the quantity of other input services used (reflected in the size of A), and the productivities of the labor inputs (reflected in the sizes of α and β, respectively).

We first consider the separate effects of prejudice on each of the general equilibrium wages. The first two left-hand columns in Table 1 show Excel calculations for each wage at different levels of prejudice, assuming that A = 5, p = 2, F = 10, β and α are 0.4, and ε and λ are one. The subsequent columns to the right provide the same type of information, but for alternative product prices, industry sizes and minority labor share parameters. As the Table shows, a decrease in customer prejudice will generally lead to higher wages in the minority job category, and minorities will experience diminishing marginal benefits from reduced prejudice ($\partial W_N/\partial D > 0$, $\partial^2 W_N/\partial D^2 < 0$). This confirms intuition; a reduction in prejudice, by upgrading customer valuation of minority output, has the same effect on minority labor as an increase in its productivity. Minority labor demand rises, leading to higher wages for that group. The behavior of the majority wage in response to reduced prejudice can be under some circumstances, however, unexpected. In the first left-hand column of the table, notice that the majority wage *falls* with reduced prejudice. This is also the case when industry size doubles (from $F = 10$ firms to $F = 20$) and when the minority share parameter rises (from $\beta = 0.4$ to 0.5). According to the table, only at the higher product price of 4 will the majority wage rise in response to reduced prejudice.

The prediction that the majority wage falls when there is less prejudice clearly runs counter to intuition, as well as what a partial equilibrium analysis of the majority wage (equation (10)) would reveal (if one differentiates that equation with respect to D, the partial derivative is always positive). Intuition would suggest that the majority wage will always rise when there is reduced prejudice; Since the two types of labor are complementary in production, the higher minority demand should trigger higher majority demand, hence a higher majority wage. However, that may not always be the case in general equilibrium. When the minority factor becomes more valuable, then the higher MRP could sometimes induce, through its interaction with other exogenous variables, an offsetting reduction in majority labor demand. Note, however, that the same thing happens when the minority share parameter rises; comparing columns 1 and 7 in the table, when β rises from 0.4 to 0.5, the majority wage is lower at each level of prejudice. Therefore, our finding that reduced prejudice lowers the majority wage stems from a more general feature of the Cobb-Douglas production function; when one class of labor becomes more productive the wage of the other class falls in general equilibrium. Our counterintuitive finding also illustrates an important implication; the effects of prejudice on occupational pay differences are sensitive to the choice of functional form, i.e. the production technology at hand.

Another important implication from Table 1 is that the marginal effects of reduced prejudice on pay depend on the values of the other parameters, i.e. the effects of reduced prejudice on each wage interact with the other determinants of pay. For example, the marginal effect of reduced prejudice on minority pay is larger the higher is product price and the higher is the minority share parameter ($\partial^2 W_N/\partial D\partial p > 0$, $\partial^2 W_N/\partial D\partial\beta > 0$), but smaller the higher is industry size ($\partial^2 W_N/\partial D\partial F < 0$). The sensitivity of the majority wage to reduced prejudice will also depend on the values of the other exogenous variables. For example, the majority wage will fall more from a given reduction in prejudice the bigger is the industry ($\partial^2 W_M/\partial D\partial F > 0$).

Given the general equilibrium wages above, the derivation of the MDC is quite straightforward. Inserting equations (13) and (14) into equation (8), the MDC is

$$(15) \qquad MDC = \left[(\frac{Z(D<1)}{X(D<1)})(\frac{\beta D}{\alpha})^{\theta(D<1)} \right]^{\frac{1}{1-\theta(D<1)}} - \left[(\frac{Z(D=1)}{X(D=1)})(\frac{\beta D}{\alpha})^{\theta(D=1)} \right]^{\frac{1}{1-\theta(D=1)}}$$

We used Excel calculations to infer the signs of the marginal effects on MDC from changes in each of the exogenous variables. Table 2 shows specific calculations, the results of which are discussed below:

(i) *Heightened prejudice raises, at an increasing rate, the amount of wage discrimination across job assignments ($\partial MDC/\partial D < 0$, $\partial^2 MDC/\partial D^2 < 0$).*

Starting from the bottom of Table 2, notice that as D falls, the MDC rises at an increasing rate, regardless of the values of the other right-hand side variables. When customers become more prejudiced, employers reduce the usage of minority labor services, putting downward pressure on the minority wage. While, as we saw earlier, the majority wage can rise or fall, the ceteris paribus racial (gender) pay gap between job assignments will always rise when prejudice rises;

(ii) *The magnitude of discrimination across job assignments depends upon how productive minority workers are relative to majority workers ($\partial MDC/\partial \beta$, $\partial MDC/\partial \alpha \neq 0$).*

As the second and third columns of Table 2 show, for example, when the minority share parameter rises from 0.4 to 0.5, the MDC falls at any level of customer prejudice. This implies that minority workers can overcome the adverse effects of customer prejudice by becoming more productive. The reason is apparent from Table 1: when the minority occupation share parameter rises, the majority wage falls and the minority wage rises, which will reduce the MDC. In another example, as the fourth and fifth columns of Table 2 show, when the majority occupation share parameter rises from 0.4 to 0.5, the MDC rises at any level of customer prejudice. This illustrates another novel implication; when majority workers benefit from a technological advance in their job assignment, this can exacerbate wage discrimination against workers in the complementary assignment. These results imply that pay discrimination and differences in worker productivity across job assignments interact. This is in contrast to the traditional Becker/Arrow model, where discrimination is independent of worker productivity (see Arrow, page 116).

(iii) *When the minority reservation wage rises (falls), wage discrimination against those workers falls (rises)* ($\partial MDC/\partial \lambda < 0$); *When the majority reservation wage rises (falls) wage discrimination against minority workers rises (falls)* ($\partial MDC/\partial \varepsilon > 0$).

These predictions illustrate the effects that labor supply differences have on discrimination across job assignments. When minority opportunity costs rise, that group's labor supply curve becomes steeper, raising the group's wage and resulting in lower employment. Majority labor usage falls, depressing the majority wage. The resulting increase in the relative occupation wage has the effect of reducing the MDC. Exactly the opposite is true if the majority group's opportunity costs rise.

Finally, we find that changes in the number of employers, product price and the efficiency parameter (A) do not influence the MDC. For example, at each level of prejudice, a doubling of product price raises both groups' wages, but they rise in the same proportion, causing the MDC to be unchanged. The same result also occurs when industry size or the capital stock (reflected in A) double.

Monopsony

Suppose now our firm is a pure monopsony. As with the perfect competition case, we allow for labor supply differences between the two worker groups, but for convenience we assume a constant wage elasticity of supply for each group. The labor supply curve equations are:

(16) $W_M = M^{\varepsilon\phi}$

(17) $W_N = N^{\lambda\phi}$

where $\varepsilon\phi$ is the inverse of the wage elasticity of supply for majority occupation workers and $\lambda\phi$ is the inverse of the wage elasticity of supply for minority occupation workers. The inverse of the wage elasticity is a well accepted measure of the degree of monopsony power facing the firm and the greater the elasticity, the lower is the monopsony power possessed.[6] The firm's profits π are:

(18) $\pi = pAM^{\alpha}N^{\beta D} - M^{\varepsilon\phi+1} - N^{\lambda\phi+1}$.

First and second order conditions yield closed-form minority and majority labor demand equations below:

$$(19) \quad N = \left[\frac{\beta DpA}{(\lambda\phi+1)}\left(\frac{\alpha pA}{\varepsilon\phi+1}\right)^{\frac{\alpha}{\varepsilon\phi-(\alpha-1)}}\right]^{\frac{1}{\lambda\phi-\frac{\beta D\alpha}{\lambda\phi-(\alpha-1)}-(\beta D-1)}}$$

$$(20) \quad M = \left[\left(\frac{\alpha pA}{\varepsilon\phi+1}\right)\left[\left[\frac{\beta DpA}{(\lambda\phi+1)}\left(\frac{\alpha pA}{\varepsilon\phi+1}\right)^{\frac{\alpha}{\varepsilon\phi-(\alpha-1)}}\right]^{\frac{1}{\lambda\phi-\frac{\beta D\alpha}{\lambda\phi-(\alpha-1)}-(\beta D-1)}}\right]^{\beta D}\right]^{\frac{1}{\varepsilon\phi-(\alpha-1)}}$$

The firm will pay a price of $W_M = M^{\varepsilon\phi}$ for each unit of majority labor services and $W_N = N^{\lambda\phi}$ for each unit of minority labor services. Inserting expressions (19) and (20) into the labor supply equations (expressions (16) and (17)), respectively, and then inserting the resulting labor supply equations into (10), the closed form solution for MDC is the following:

$$(21) \qquad MDC = \frac{\left[\left(\frac{\varepsilon\alpha pA}{\varepsilon\phi+1}\right)\left[\left[\frac{\beta DpA}{(\lambda\phi+1)}\left(\frac{\alpha pA}{\varepsilon\phi+1}\right)^{\frac{\alpha}{\varepsilon\phi-(\alpha-1)}}\right]^{\frac{1}{\lambda\phi-\frac{\beta D\alpha}{\lambda\phi-(\alpha-1)}-(\beta D-1)}}\right]^{\beta D}\right]^{\frac{\varepsilon\phi}{\varepsilon\phi-(\alpha-1)}}}{\left[\frac{\beta DpA}{(\lambda\phi+1)}\left(\frac{\alpha pA}{(\varepsilon\phi+1)}\right)^{\frac{\alpha}{\varepsilon\phi-(\alpha-1)}}\right]^{\frac{\phi}{\lambda\phi-\frac{\beta D\alpha}{\lambda\phi-(\alpha-1)}-(\beta D-1)}}} - \frac{\left[\left(\frac{\alpha pA}{\varepsilon\phi+1}\right)\left[\left[\frac{\beta pA}{(\lambda\phi+1)}\left(\frac{\alpha pA}{\varepsilon\phi+1}\right)^{\frac{\alpha}{\varepsilon\phi-(\alpha-1)}}\right]^{\frac{1}{\lambda\phi-\frac{\beta\alpha}{\lambda\phi-(\alpha-1)}-(\beta-1)}}\right]^{\beta}\right]^{\frac{\varepsilon\phi}{\varepsilon\phi-(\alpha-1)}}}{\left[\frac{\beta pA}{(\lambda\phi+1)}\left(\frac{\alpha pA}{(\varepsilon\phi+1)}\right)^{\frac{\alpha}{\varepsilon\phi-(\alpha-1)}}\right]^{\frac{\phi}{\lambda\phi-\frac{\beta\alpha}{\lambda\phi-(\alpha-1)}-(\beta-1)}}}$$

According to equation (21), the optimal value of MDC depends on the degree of customer prejudice, the amount of monopsony power possessed by the firm in the majority and minority occupation labor markets ($\varepsilon\phi$ and $\lambda\phi$ respectively), the relative productivities of the labor inputs and labor supply differences.

Excel calculations were used to sign the marginal effects of the right-hand side variables on the MDC in equation (21). In all of the calculations discussed below, we assume away the possibility of monopsonistic wage discrimination due to differences in wage elasticities of supply, i.e. $\varepsilon = \lambda$. Some of our results mirror what was found for perfect competition, others are unique to the pure monopsony case. Below is a summary of key findings from the numerical analysis:

(i) *An increase in customer prejudice will reduce employment and wages in both job assignments, but will heighten the amount of wage discrimination across assignments.*

Table 3 shows calculations for employment and wages for alternative values of the customer discrimination parameter (*D*). These calculations are done for three different sets of share parameters, assuming A = 5, p = 2 and a wage elasticity ($1/\phi$) equaling 1. We note that, given the labor supply curves assumed earlier, when the wage elasticity is unity wages are identical to employment levels. For all three sets of calculations, an increase in prejudice reduces employment and wages for both classes of labor, but raises the amount of wage discrimination. The reason is that the minority wage falls faster than the majority wage, causing *MDC* to rise.

(ii) *The amount of wage discrimination across job assignments depends on productivity differences between occupations.*

The relative productivity of minority labor will rise if the minority worker group's partial elasticity of output rises relative to the majority worker group's partial elasticity of output. Table 4 shows calculations of *MDC* for alternative pairs of the share parameters, assuming that the share parameters sum to 0.8. In these calculations, we assume that $D = 0.9$, $\phi = 1$, $A = 5$ and $p = 2$. At the same level of customer prejudice, *MDC* declines as the minority elasticity rises and/or the majority elasticity falls. This result is identical to what was found for the perfect competition case.

(iii) *When the labor market becomes less competitive, wage discrimination may not always rise. Greater monopsony power is capable of reducing discrimination under certain conditions.*

Table 5 shows calculations of *MDC* for values of the wage elasticity of supply ranging from 0.001 (almost pure monopsony) to infinity (perfect competition), assuming that $A = 5$, $p = 2$, $D = 0.8$ and the share parameters sum to 0.8. The calculations are performed for three cases: (a) the share parameters are equal; (b) the majority share parameter is relatively large; and (c) the minority share parameter is relatively large. As Table 5 shows, for cases (a) and (b) an increase in monopsony power unambiguously bolsters wage discrimination. For case (a), *MDC* nears 25% when the firm approaches the state of pure monopsony. For case (b), wage discrimination can be very substantial as the forces of competition lessen. Case (c) is perhaps the most interesting. For that case, *MDC* initially rises with an increase in monopsony power, but begins to decline for values of the wage elasticity below 1. However, it should be noted that a decline in *MDC* can only occur for a specific range of values for the wage elasticity and only if the minority share parameter is sufficiently large. When monopsony power rises, marginal and average costs of labor rise, inducing the firm to employ less labor services from each occupation (note that Excel calculations confirm that $\partial M/\partial \phi$ and $\partial N/\partial \phi < 0$) and pay lower wages. Common to the three cases above is that wages in both occupations with and without prejudice will decline when monopsony power rises. However, the occupational wage ratios with and without prejudice can rise, fall or stay the same, depending upon the sizes of the share parameters. Consequently, *MDC* can rise, fall or stay the same when monopsony power rises.[7]

III. A Test Case: Major League Baseball During the 1990s

In testing our two models above, we sought an industry where: (a) production requires the employment of labor in complementary job assignments and the production function is compatible with the Cobb-Douglas case developed above; (b) the pay of some members of the labor force is competitively determined, whilst the pay of others is determined under conditions resembling monopsony; (c) accurate data on worker-specific productivity, personal characteristics and contract status are readily available; (d) there is some degree of racial or gender segregation between occupations and a long term history of discrimination in the industry; (e) customers can observe worker performance, hence they are a potential source of racial or gender discrimination in salaries; and (f) there have been changes in the number of employers in the industry, allowing for a natural experiment of the effects of changes in the degree of monopsony power over time.

One industry conveniently satisfying these criteria is Major League Baseball (MLB) in the USA.[8] In MLB, each team (firm) requires, in addition to other skills, two distinctly complementary types of player skill – hitting (an offensive skill) and pitching (a defensive skill). Thus, hitting and pitching services are complementary in the production of baseball entertainment. Furthermore, Woolway (1997) and Zech (1981) have argued that the Cobb-Douglas function, with its feature of imperfect complementarity, is an entirely appropriate form for the analysis of production in MLB.[9]

In MLB player salaries are set under two different regimes, one competitive, the other monopsonistic. The monopsonistic regime applies to players with fewer than six years of MLB experience. These players are subject to the *reserve clause* and are constrained to negotiate their pay with only one team. The competitive regime applies to players with at least 6 years of MLB experience. They are eligible to file for *free agency* and may negotiate with any team in the league. Monopsony power effectively begins to erode, however, as early as the fourth year because then a player is eligible for *final offer arbitration*. Arbitration rights tend to relieve players of monopsonistic exploitation because arbitrators strive to award competitive salaries. Pitchers have historically been disproportionately White, whereas the pool of hitters has tended to be more racially balanced. The Major League added new teams (called 'expansion teams') since the early 1990s, leading to a reduction in each team's degree of monopsony power held over reserve clause players. For all these reasons, MLB is a very attractive candidate for the study of wage discrimination across complementary job assignments.

The ideal way to measure a Major League player's marginal revenue product (MRP) is by his contribution to the team's ticket, broadcasting and merchandise revenues. Because of the team production nature of baseball, however, it is impossible to directly measure a player's revenue contribution. We thus proxy MRP by the player's years of Major League experience, tenure with his current club, and various career statistics (computed on a game-by-game basis since the beginning of the player's Major League career) that proxy his ability and skills. The career statistics we use to measure a hitter's productivity include *at bats*, *stolen bases*, *bases on balls*, *total bases*, *slugging average* and *batting average*.[10] We distinguish between hitters that are 'designated hitters' from those who are not. A designated hitter is a player who is chosen at the start of the game to bat in lieu of the pitcher in the lineup. We also distinguish, using dummies, between hitters that serve other types of positions. These include whether the hitter served as an infielder or a catcher.[11] We measure a pitcher's productivity by use of the following career statistics: *Wins*, *Losses*, *Games Started, Complete Games, Saves, Homeruns, Walks, Strikeouts, Innings Pitched, Earned Run Average (ERA) and Strikeout Rate.*[12]

Empirical Analysis

Our empirical analysis is set out in Tables 6-18. Tables 6 and 7 present descriptive statistics for hitters and pitchers, respectively. The full sample includes 1093 hitters (549 White and 544 non-White) and 1204 pitchers (948 White and 256 non-White). Salary, experience, performance and position data were drawn from the *Lahman Baseball Database* (www.baseball1.com) over four seasons - 1992, 1993, 1997 and 1998. The Major League expanded by two teams between 1992 and 1993 and again by two teams between 1997 and 1998. The salary data do not include information about contract length, bonus clauses or endorsements. Salaries for players on the Canadian teams were converted to U.S. dollars. The experience data were used to determine the player's eligibility for free agency and final offer arbitration and the player's race was inferred from inspection of *Topps* baseball cards for all four seasons. For the U.S. teams, metropolitan area population and per-capita income were obtained from the website of the Bureau of Economic Analysis (www.bea.gov). For the Canadian teams, similar data were obtained from the Statistics Canada website (www.statcan.ca). Per-capita income data for the Canadian cities were converted to U.S. dollars.

From Table 6, one can see that there are no major differences between the personal and professional characteristics of White and non-White hitters, nor in the characteristics of the greater metro area in which they play. In terms of career characteristics, however, it is apparent that non-White hitters record significantly more *At Bats* and *Stolen Bases* than Whites, *vis*. 2593.9 and 2419.7 and 94.9 and 44.8, respectively. Whites are, however, significantly more likely than non-Whites to play as an infielder or catcher and less likely to play as an outfielder or designated hitter.

In Table 7, the domination of White pitchers is immediately apparent. It is evident that White pitchers are on average older than non-White pitchers, over whom they also enjoy higher average earnings. In terms of career characteristics, White pitchers record significantly higher *Wins*, *Losses*, *Games Started*, *Complete Games*, *Shutouts*, *Saves*, *Homeruns*, *Walks*, *Strikeouts* and *Innings Pitched* than their non-White counterparts. Non-Whites do, however, record relatively higher *ERA's* and *Strikeout Rates*.

Tables 8 and 9 set out our preliminary earnings regressions for Hitters and Pitchers, respectively. We estimate seven specifications *vis*. (1) All; (2) Whites; (3) Non-Whites; (4) Early Period (1992-1993); (5) Latter Period (1997-1998); (6) Competitive (i.e. Hitters or Pitchers who are *Free Agents* or *Eligible for Final Offer Arbitration)*; and (7) Non-Competitive (i.e. Hitters or Pitchers who are neither *Free Agents* nor *Eligible for Final Offer Arbitration*). Looking at Hitters first (Table 8), it is evident that the regressions are generally well specified, and that the coefficients on the explanatory variables are generally robust, across all the various specifications. Earnings are negatively related to *Age* but positively and concavely related to *MLB Experience*. It would appear that the negative coefficient on *Age* is reflecting the player's physical depreciation, whilst the positive coefficient on experience is reflecting rewards to greater human capital – indeed when we experimented with dropping age from our regressions we found that the coefficient on *MLB Experience* declined by almost exactly the size of the coefficient on *Age*. Earnings are also positively and significantly related to *Tenure with Current Club* and also to whether the player is a *Free Agent* or *Eligible for Final Offer Arbitration*. Career characteristics are dominated by the effects of a player's *Slugging* and *Batting Average*, although *At Bats* and *Stolen Bases* exert small, but significant effects on earnings. Somewhat surprisingly, *Slugging Average* and *At Bats* impact negatively on earnings when attention is confined to 'monopsonised' players – i.e. those who are neither *Free Agents* nor *Eligible for Final Offer Arbitration*.

In terms of the *Greater Metro Area Characteristics* that we incorporate as proxies for customer discrimination, it is evident that there was a dramatic shift in the relationship between Hispanic populations and the earnings of hitters over the periods 1992-1993 and 1997-1998, a significantly negative correlation in the former becoming significantly positive in the latter. There was both an increase in the number of teams and a general decline in monopsony power over this period, either of which could have been at work here, and we explore this issue in more detail in Tables 11-14 following.

Turning to our preliminary regressions for the earnings of pitchers (Table 9), we find that whilst *MLB Experience* and *Tenure with Current Club* impact relatively similarly upon the earnings of both White and non-White pitchers, *Age* impacts negatively on the earnings of the latter but has no effect on the earnings of the former. There is also a racial effect in terms of 'competitive' and 'non-competitive' players – White, but not non-White, pitchers who are either *Free Agents* or *Eligible for Final Offer Arbitration* enjoy significantly higher earnings. The premium to all competitive players, however, declined over the two periods 1992-1993 and 1997-1998.

The coefficients on the productivity variables generally accord to *a priori* expectations, although there are some noticeable discrepancies across the various sub-sample regressions. For example, the pay of non-White, but not White, pitchers is significantly and positively related to *Wins*, and significantly and negatively related to *Games Started* and *Complete Games*. White, but not non-White, pitcher pay is significantly and positively related to *Saves*, and significantly and negatively related to *Shut Outs*, *Walks*, *Home Runs*, and *ERA*.. Very surprisingly, the earnings of White pitchers are positively related to *Strikeouts*, whilst that of non-White pitchers are negatively related. Other discrepancies are apparent across the *Early Period* and *Latter Pe*riod regressions and across the *Competitive* and *Non-Competitive* regressions – interestingly, in the latter case many of the productivity variables become insignificant when attention is restricted to pitchers who are neither *Free Agents* nor *Eligible for Final Offer Arbitration*. In terms of the *Greater Metro Area Characteristics*, there again appears to have been an impact from Hispanic populations, this time correlating positively with the earnings of White pitchers over the whole sample period and with all pitchers over the latter half of the period (1997-1998).

To make further progress in ascertaining the level of discrimination across player job assignments (positions), we need to control for position-specific productivity. In one sense this is straightforward because some measures of productivity (i.e. off-field productivity) are common across pitchers and hitters; e.g. MLB experience and tenure with current club. On-field measures of productivity, however, vary across hitters and pitchers; e.g. runs and strike-outs. Given our objective of ascertaining the extent of racial discrimination across job assignments, we need to control for productivity differences across these two positions. To achieve this we adopt the following two-stage approach. We first assume that wages reflect productivity as follows:

$$(22)\qquad \begin{aligned} w_h &= \mathbf{B}_0^h \mathbf{X}^h + \mathbf{B}_1^h Z \\ w_p &= \mathbf{B}_0^p \mathbf{X}^p + \mathbf{B}_1^p Z \end{aligned}$$

where w_h and w_p denote the wages of hitters and pitchers respectively, $\mathbf{X}^h$ and $\mathbf{X}^p$ denote the 'position-specific' productivity measures (e.g. runs, strike–outs, etc), Z denotes the 'common' productivity measures (e.g. age, MLB experience, etc) and the B's denote parameter vectors. Our aim is to derive an estimating equation of the form:

$$(23)\qquad w_i = \mathbf{B}_0^i \mathbf{X} + \mathbf{B}_1^i Z$$

where *i* = *h*, *p* denotes hitters and pitchers and $\mathbf{X}$ denotes some common 'artificial' measure of productivity related to on-field performance. We therefore estimate the following 'first-stage' regressions:

$$(24)\qquad \begin{aligned} w_h &= \mathbf{A}_0^h \mathbf{X}^h \\ w_p &= \mathbf{A}_0^p \mathbf{X}^p \end{aligned}$$

That is, we estimate separate wage regressions for hitters and pitchers on only their respective position specific variables vis. Pitchers - *Starter*; *Wins*; *Losses*; *Games Started*; *Complete Games*; *Shutouts*; *Saves*; *Homeruns*; *Walks*; *Strikeouts*; *Innings Pitched*; *ERA*; Strikeout Rate: Hitters – *At Bat*; *Stolen Bases*; *Bases on Balls*; *Total Basses*; *Slugging Average*; *Batting Average*; *Infielder*; *Outfielder*; *Catcher*; *Designated Hitter*. We then use the predicted values from these regressions,

$\hat{w} = \left(\hat{w}_h, \hat{w}_p\right)$, as our common on-field measure of productivity in a second-stage regression of the form:

(25) $$w_i = \beta_0^i \hat{w} + \mathbf{B}_1^i Z$$

Table 10 reports second-stage regressions with White Pitchers, Non-White Pitchers, White Hitters, and Non-White Hitters defined as the default race-position category respectively.

It is apparent from Table 10 that there is significant racial discrimination across player job assignments. Holding on-field productivity, as well as other determinants of player salary constant, White-pitchers earn 10.3 percent more than non-White hitters and non-White pitchers earn 8.6 percent more than White hitters. What is particularly interesting is the latter figure, which suggests evidence of *reverse* racial discrimination across job assignments. There is also evidence of significant intra-job assignment pay discrimination: White pitchers earn 8.6 percent more than non-White pitchers, but White hitters earn 6.8 percent *less* than non-White hitters, the latter figure suggesting evidence of reverse discrimination against White hitters.

Table 11 decomposes the analysis of Table 10 to the Competitive and Non-Competitive player markets. It appears that discrimination across job assignments is heightened in the non-competitive market; Non-White hitters ineligible for free agency and final offer arbitration earn 11.5 percent less than White pitchers. However, there is no evidence of a pay gap between White hitters and non-White pitchers for this group. Within the Competitive market, we find no evidence of a pay gap between White pitchers and non-White hitters. However, White hitters were found to earn 17.1 percent less than non-White pitchers, indicating that the competitive salary determination process for this group did not assuage reverse racial discrimination across the two job assignments.

Table 12 focuses on the early 1990s introduction of expansion teams which lead to a reduction in each team's degree of monopsony power held over reserve clause players. It is immediately apparent that discrimination was lower in the post-expansion period (1997, 1998) relative to the pre-expansion period (1992, 1993), with White pitchers enjoying pre-expansion (post-expansion) differentials of 23.4 (2.3) percent over non-White hitters, 21.9 (12.4) percent over White hitters, and 10.6 (10.2) percent over non-White hitters.

Tables 13 and 14 decompose the analysis of Table 12 into the competitive and non-competitive markets respectively. It is evident from these that the expansion of the league had the most marked effect on the non-competitive market, with White pitchers here enjoying pre-expansion (post-expansion) differentials of 35.4 (5.4) percent over non-White hitters, 26.6 (10.6) percent over White hitters and 13.8 (9.2) percent over non-White hitters. There were no pre-expansion earnings differentials relative to White pitchers within the competitive market, although non-White pitchers enjoyed a 19 percent differential over White pitchers and a 27.8 per cent differential over White hitters after the expansion of the league.

Tables 15-17 focus on the potential role of customer prejudice following the prediction from our theoretical and numerical analysis that within a competitive labor market, an increase in customer prejudice will heighten the amount of wage discrimination across job assignments. Table 15 divides the various greater metropolitan areas into those with below or above average non-White populations. It is noticeable that within greater metropolitan areas that have below-average non-White populations, White hitters earn 15.2 percent less than non-White pitchers, whereas within greater metropolitan areas that have above average non-White populations, non-White hitters earned 18.2 percent less than White pitchers.

Tables 16 and 17 extend the analysis of Table 15 to the competitive and non-competitive sectors, respectively. Taking the competitive sector first (Table 16), it is apparent that within below average non-White greater metropolitan areas, non-White hitters enjoy a differential of some 16.9 per cent over White pitchers ceteris paribus. This differential is eliminated in greater metropolitan areas that have above average non-White populations. However, in these areas, non-White pitchers enjoy a 13.9 per cent differential over White pitchers, a 19.4 per cent differential over White hitters, and a 23.5 percent differential over non-White hitters, all other things being equal. Moving on to the non-competitive sector (Table 17), it is apparent that within below average non-White greater metropolitan areas, both White pitchers and non-White hitters enjoy an earning differential over

White hitters (22.5 per cent and 17.2 per respectively). Within above average non-White greater metropolitan areas, however, White pitchers enjoy differentials over all three other player-types – White hitters (14.5 per cent), non-White pitchers (20.5 per cent) and non-White hitters (18.7 per cent).

Finally, in Table 18 we explore our theoretical prior that wage discrimination across player job assignments interacts with productivity differences between White hitters (pitchers) and non-White pitchers (hitters). We test this prediction by creating a *Relative Productivity* variable that equals the difference between the player's productivity and the mean productivity of players in the opposite racial/position group multiplied by the player's productivity. Thus, in Column (1) of Table 18, where we focus on White Pitchers relative to Non-White Hitters, our *Relative Productivity* variable equals *Individual White Pitcher Productivity* x (*Individual White Pitcher Productivity* - *Mean Non-White Hitter Productivity*), where productivity is estimated according to the two-stage process outlined in equations (22)-(25).

It would appear from Table 18 that White hitters earn less than non-White pitchers *ceteris paribus*, but that this differential is reduced as White hitter productivity rises relative to mean non-White pitcher productivity. Thus, the reverse discrimination suffered by White pitchers is partially alleviated by an improvement in White pitcher productivity. There is no statistically significant (at the 10 percent level) inter-racial pay differential between White pitchers and non-White hitters.

Decomposition Analysis

The fact that players of a particular race in a particular position enjoy a wage differential *ceteris paribus* could be a reflection of their greater endowment of 'earning characteristics' – White pitchers may, for example, be more productive, or have more experience on average than non-White hitters. Alternatively, they may be better rewarded for the characteristics they do possess, suggesting some form of positive (negative) discrimination from employers towards White pitchers (non-White hitters). To address this issue we perform an Oaxaca-decomposition to separate the earnings differential into an endowment component, to account for differences in endowments between individuals, and a price component, which is usually associated with discrimination.[13]

We assume that the earnings function of a representative player i of race J in position K is given by:

$$\ln w_i^{JK} = \mathbf{X}_i^{JK}\mathbf{B}^{JK} + \varepsilon_i^{JK} \tag{26}$$

Where $J = W$, NW and $K = P$, H denote Whites and non-Whites and pitchers and hitters respectively. $\mathbf{X}$ denotes a vector of individual-career characteristics, $\mathbf{B}$ the corresponding coefficient vectors to be estimated, and ε some well-behaved error term. Thus, the earnings functions of white Pitchers, non-White Pitchers, White Hitters and non-White Hitters may be denoted:

$$\ln w_i^{WP} = \mathbf{X}_i^{WP}\mathbf{B}^{WP} + \varepsilon_i^{WP} \tag{27}$$

$$\ln w_i^{NWP} = \mathbf{X}_i^{NWP}\mathbf{B}^{NWP} + \varepsilon_i^{NWP} \tag{28}$$

$$\ln w_i^{WH} = \mathbf{X}_i^{WH}\mathbf{B}^{WH} + \varepsilon_i^{WH} \tag{29}$$

$$\ln w_i^{NWH} = \mathbf{X}_i^{NWH}\mathbf{B}^{NWH} + \varepsilon_i^{NWH} \tag{30}$$

The predicted average White pitcher/non-White hitter (WP-NWH) differential may therefore be represented as:

$$\begin{aligned} &\Delta \ln w^{WP-NWH} = \ln w^{WP} - \ln w^{NWH} = \overline{\mathbf{X}}^{WP}\hat{\mathbf{B}}^{WP} - \overline{\mathbf{X}}^{NWH}\hat{\mathbf{B}}^{NWH} \\ &\Rightarrow \\ &\Delta \ln w^{WP-NWH} = \overline{\mathbf{X}}^{WP}\left(\hat{\mathbf{B}}^{WP} - \hat{\mathbf{B}}^{NWH}\right) + \hat{\mathbf{B}}^{NWH}\left(\overline{\mathbf{X}}^{WP} - \overline{\mathbf{X}}^{NWH}\right) \end{aligned} \tag{31}$$

The first term, $\overline{\mathbf{X}}^{WP}\left(\hat{\mathbf{B}}^{WP} - \hat{\mathbf{B}}^{NWH}\right)$, represents differences in rewards whilst the second term, $\hat{\mathbf{B}}^{NWH}\left(\overline{\mathbf{X}}^{WP} - \overline{\mathbf{X}}^{NWH}\right)$, represents differences in endowments. Note that if the overall differential is negative (i.e. $\Delta \ln w^{WP-NWH} < 0$) but the first term is positive [i.e. $\overline{\mathbf{X}}^{WP}\left(\hat{\mathbf{B}}^{WP} - \hat{\mathbf{B}}^{NWH}\right) > 0$] then it would suggest that non-White hitters are discriminated against despite earning, on average, more than White hitters - i.e. non-White hitters would do even better with the earnings generating function of White pitchers than with their own.

Specification (31) presumes that the non-White hitter wage structure would hold in the absence of discrimination. But we may equally presume that the White pitcher wage structure would hold, thereby re-specifying (31) as:

$$(32) \qquad \Delta \ln w^{WP-NWH} = \overline{\mathbf{X}}^{NWH}\left(\hat{\mathbf{B}}^{WP} - \hat{\mathbf{B}}^{NWH}\right) + \hat{\mathbf{B}}^{WP}\left(\overline{\mathbf{X}}^{WP} - \overline{\mathbf{X}}^{NWH}\right)$$

It is perhaps naive, however, to assume that either the White hitter or non-White pitcher wage structure would prevail in the absence of discrimination. Instead, a hybrid structure could emerge requiring the decomposition technique proposed by Cotton (1988):

$$(33) \qquad \Delta \ln w^{WP-NWH} = \overline{\mathbf{X}}^{WP}\left(\hat{\mathbf{B}}^{WP} - \overline{\mathbf{B}}\right) + \overline{\mathbf{X}}^{NWH}\left(\overline{\mathbf{B}} - \hat{\mathbf{B}}^{NWH}\right) + \overline{\mathbf{B}}\left(\overline{\mathbf{X}}^{WP} - \overline{\mathbf{X}}^{NWH}\right)$$

where $\overline{\mathbf{B}} = \mathbf{\Omega}\hat{\mathbf{B}}^{WP} + \left(1 - \mathbf{\Omega}\right)\hat{\mathbf{B}}^{NWH}$ represents the estimated non-discriminatory wage structure, with $\mathbf{\Omega}$ denoting the proportion of the sample comprised by White pitchers. The first term of the decomposition is the overpayment enjoyed by White pitchers, the second term is the underpayment suffered by non-White hitters, and the third term is the portion of the wage differential that is explained by differences in endowments.

We perform the above three decompositions for the White pitcher/non-White hitter and White hitter/non-White pitcher differentials, and our results, based on the regressions set out in Table 10 are collected in Table 19 (WP-NWH) and Table 20 (WH-NWP), respectively.

Considering Table 19, our regression model implies a positive wage premium for non-White hitters over White pitchers *ceteris paribus*. The first decomposition follows specification (31) in presuming that the non-White hitter wage structure would prevail in the absence of any discrimination, suggests that approximately 52 percent per cent of the differential may be attributed to discrimination *against* White pitchers and some 48 per cent to the superior endowments on average of non-White hitters. The second decomposition, which follows specification (32) in presuming that the White pitcher wage structure would prevail, suggests that discrimination against White pitchers accounts for a somewhat larger contribution (some 57 percent) of the overall differential .

The final 'hybrid' decomposition, derived from specification (33), suggest that almost 55 per cent of the overall differential is attributable to discrimination against White pitchers, with just under 35 percent of this price effect (almost 19 percentage points) attributable to White pitchers being underpaid, and slightly more than 65 per cent (36 percentage points) to non-White hitters being overpaid, relative to that which they might each be presumed to earn in the absence of discrimination.

Table 20 focuses on the White pitcher/non-White hitter differential. Our regression model here implies a positive wage premium for non-White pitchers over White hitters *ceteris paribus*. The decompositions of this differential suggests an even larger discrimination effect, with those based on the non-White pitcher wage structure suggesting that almost 200 percent per cent of the differential may be attributed to discrimination *against* White hitters – the superior endowments of White hitters relative to non-White pitchers on average would, in the absence of discrimination, almost completely reverse the wage differential against them. The decomposition based on the White hitter wage structure confirms the notion of substantial price effects, with some 212 per cent of the overall premium being attributable to discrimination against White hitters.

The White Hitter/Non-White Pitcher 'hybrid' decomposition echoes these findings, with anti-White hitter discrimination acting to overturn completely the wage premium they would otherwise enjoy, on account of their superior endowments on average, over non-White pitchers. To be sure, the hybrid decomposition suggests that almost 207 per cent of the overall differential is attributable to discrimination against White hitters. Interestingly , we find again that just over one-third of this price effect (72 percentage points) is attributable to Whites being underpaid, and slightly less than two-thirds (135 percentage points) to non-Whites being overpaid, relative to that which they might each be presumed to earn in the absence of discrimination.

IV. Concluding Remarks

In this study, we address a previously un-researched problem in the literature on taste discrimination in pay: Ascertaining the extent to which majority/minority differences in pay across job assignments are attributable to prejudice. Nearly all wage discrimination studies have focused on discrimination within the same job assignment, thus treating majority and minority workers as perfect substitutes. We extend the theory to the case of discrimination across job assignments where assignments are complementary in production. Our results suggest that discrimination between assignments depends on majority/minority productivity differences, the magnitude of prejudice and the degree of monopsony power. Our theoretical findings underscore the importance of considering the role of the firm's production function as a key to understanding pay discrimination across job assignments. We tested our model using data from Major League Baseball, an industry characterized by racial segregation between complementary job assignments, a history of racial discrimination and a dual labor market structure. We found convincing evidence of racial differences in pay across player job assignments, even after controlling for a wide array of demographic variables and position-specific productivity. Moreover, we find strong evidence of our theoretical prior that racial pay differentials across assignments are affected by changes in relative productivities.

This study can be seen as making three contributions. First, it extends the traditional theory of within-job assignment wage discrimination to the case of discrimination across job assignments. It was found that when the traditional wage discrimination model was extended in this manner, some novel predictions were obtained. Second, the study extends the classical theory of monopsony to the case where the firm practices wage discrimination due to prejudice using a particular type of technology. Third, the study presents a preliminary test of pay discrimination across job assignments based on our theoretical model. One potentially fruitful extension of the above model would be a general equilibrium approach in which occupational segregation and wage discrimination are both endogenous.

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Endnotes

[1] These numbers are taken from the Bureau of Labor Statistics website (http://www.bls.gov/cps/cpsaat39.pdf).
[2] The goal of this model is to explain wages and the degree of racial discrimination between assignments only. A more complete model would also endogenize racial segregation across occupations and examine the tradeoff between the degree of integration and the amount of discrimination. That is beyond the scope of the present study, but certainly a very worthwhile topic for future studies.
[3] Kahn (1991) took a similar approach. In his model of affirmative action when there is customer discrimination, the fraction D is used to discount minority labor input, whereas in the model above D discounts output. Both approaches have the same implication, namely that majority customers value the output of minority workers by a fraction of what they do majority workers.
[4] The signs of these partial derivatives were obtained from numerical analysis. Using Excel, we calculated the values of M and N for different values of D, assuming different sets of values for the other parameters in the demand equations. For example, assuming $A = 5$, $p = 2$, $F = 10$ and α and β are both 0.4, majority (minority) labor usage falls from 275.39 (247.85) to 109.51 (87.61) when D falls from 0.9 to 0.8. These and other calculations are available from the authors upon request.
[5] This expression is identical to Becker's (1971, pg. 17) general expression for the MDC, which he treats as the economy-wide wage gap when there is employment discrimination.
[6] For example, Sullivan (1989) estimated a hospital's monopsony power using the inverse elasticity of wage supply for nursing services.
[7] In case (a), an increase in monopsony power will raise *MDC* because the wage ratio with prejudice rises, whereas the wage ratio without prejudice stays even at 1. In case (b), both wage ratios rise, but the wage ratio with prejudice rises faster than the ratio without prejudice. In case (c), both wage ratios actually fall, but the wage ratio without prejudice declines faster. Note in case (c) that since the *MRP* of minority occupation workers is so large relative to majority occupation workers, the minority wage exceeds the majority wage. However, when equation (21) is used to control for these large productivity differences, the wage ratio attributable solely to prejudice is in favor of majority workers. Cases (a) and (b) are similar to what Becker (1971, pp. 43-47) found in his model of employer discrimination. Becker's model, however, is very different from the one presented here for several reasons. First, his model is not of a single firm, but of an economy with a perfectly competitive labor market in which firms can indulge prejudicial tastes only by adjusting the minority shares of their workforces. The wage differential in Becker's model is the same for all firms and reflects a diffuse distribution of prejudicial tastes across firms. Second, Becker studied the relationship between employer prejudice and the degree of competition in the product market, whereas the model above examines how the amount of labor market power possessed by one firm influences the strength of wage discrimination within that firm. Cases (a) and (b) also are similar to the findings of Fujii and Trapani (1978), who hypothesized that when a firm possesses monopsony power, wage discrimination varies inversely with the wage elasticity of supply. However, Fujii and Trapani assume perfect substitution. This analysis has two novel implications. First, as case (c) shows, competition in the labor market is not guaranteed to alleviate interoccupational wage discrimination ($\partial MDC/\partial\phi$ is not always positive). In fact, it is possible that under certain conditions, a more competitive labor market could augment the amount of discrimination! This implication is novel because it has been considered conventional wisdom in the discrimination literature, beginning with Alchian and Kessel (1962) and Becker (1971), that competition is always an effective remedy for alleviating wage discrimination. Second, the degree to which monopsony power can affect wage discrimination depends partly on how important minority occupation workers are in production. For cases (a) and (b), for example, as minority occupation workers become more important in production, the marginal effect of an increase in monopsony power on wage discrimination will lessen ($\partial^2 MDC/\partial\beta\partial\phi < 0$).
[8] Wage discrimination in professional sports has received considerable attention among labor economists because of the abundant statistical evidence on a player's personal attributes, compensation and productivity. Most studies of wage discrimination in professional sports have focused on racial discrimination with respect to pay, hiring, retention and positional segregation. For a relatively recent examination of the research in this area, see Kahn's [2000] expository survey.
[9] Woolway and Zech both estimated Cobb-Douglas functions where the dependent variable is team winning percentage and the independent variables are player or team career statistics.
[10] A player has an *at bat* every time he comes to bat, except in certain circumstances, e.g. if he is awarded first base due to interference or obstruction or the inning ends while he is still at bat. A hitter is assigned a stolen base (also called a 'steal') when he reaches an extra base on a hit from another player. For example, suppose that hitter A is at first base when hitter B hits the ball. Hitter B reaches first base (he would be assigned a 'single'), but hitter A reaches third base. Hitter A would be assigned a stolen base because he reached an extra base. A base on balls (also called a 'walk') is assigned when the batter receives four pitches which the umpire determines is a 'ball.' A ball is any pitch at which the batter does not swing and is out of the 'strike zone' (which means it would not qualify to be a strike). When the hitter is assigned a base on balls, he is entitled to walk to first base. Total bases are the number of bases a player has gained through hitting. It is the sum of his hits weighted by 1 for a single, 2 for a double (if he gets to second base as a result of his hit), 3 for a triple (if he gets to third base) and 4 for a home run. A hitter's batting average is the ratio of hits to at bats; this measures the hitter's success rate. Slugging percentage, a related measure, reflects his hitting power. It is calculated as total bases divided by at bats.

[11] An infielder is a defensive player who plays on the 'infield,' the dirt portion of a baseball diamond between first and third bases. The specific infielder positions are first baseman, second baseman, shortstop (which is between second and third bases) and third baseman. In contrast, an 'outfielder' plays farthest from the batter and his primary role is to catch long fly balls. Outfielder positions include left fielder, center fielder and right fielder. The catcher crouches behind home plate and receives the ball from the pitcher. Because the catcher can see the whole field, he is best positioned to lead and direct his fellow players in play. He typically calls the pitches by means of hand signals, hence requires awareness of both the pitcher's mechanics and strengths and the weaknesses of the batter.

[12] A pitcher is assigned a *win* or a *loss* depending on whether he was the *pitcher of record* when the decisive run was scored. One is the pitcher of record if one is the pitcher at the point when the player who scores the decisive run is allowed to reach a base. *Games started* is the number of times the pitcher was given the ball to start a game, whereas *games finished* is the number of times the pitcher was throwing on the mound during the final *out* (which is any failed attempt by a hitter to advance to a base). A *shutout* is a game in which one team does not score any runs. A pitcher earns a *save* if he is able to hold a lead for his team at the end of the game. Pitchers who earn saves, called *relievers*, tend not to gain wins, so it is customary to treat saves and wins equally, especially when studying pitcher salaries. Number of *home runs*, which is assumed to be negatively related to salary, is the number of pitches that were hit by batters which were scored as a home run. A pitcher is assigned a *walk*, which is assumed to be negatively related to salary, if he allows a batter to reach base after pitching him four balls. He is assigned a *strikeout* if he pitches three *strikes* (pitched balls counted against the batter, typically swung at and missed or fouled off) in a row. An *inning* is one of nine periods in a MLB game in which each team has a turn at bat; *innings pitched* is the number of such periods when the pitcher was working. *Earned run average* is negatively correlated with the pitcher's ability to prevent the opposing team from scoring. It equals the number of times the pitcher allows a batter to score a *run* (where the batter scores a point by advancing around the bases and reaching home plate safely) x 9, divided by the number of innings pitched. Finally the *strikeout rate* is the percentage of times the pitcher has succeeded in striking a batter out.

[13] This method of decomposition, initially proposed by Oaxaca (1973) and Blinder (1973), and later generalized by Oaxaca and Ransom (1994), has been applied extensively to discrimination on the basis of gender, race, caste and religion.

Table 1: The Effects of Prejudice on Wages under Perfect Competition

D	W_M (p=2,F=10, β=0.4)	W_N (p=2,F=10, β=0.4)	W_M (p=4,F=10, β=0.4)	W_N (p=4,F=10, β=0.4)	W_M (p=2,F=20, β=0.4)	W_N (p=2,F=20, β=0.4)	W_M (p=2,F=10, β=0.5)	W_N (p=2,F=10, β=0.5)
0.5	4.94601	3.497357	8.114774	5.738012	6.029254	4.26333	4.85657	3.83946
0.6	4.873289	3.774833	8.112744	6.284104	5.8454726	4.53505	4.78053	4.14006
0.7	4.809515	4.023929	8.131194	6.803034	5.6895600	4.76022	4.71552	4.41096
0.8	4.753304	4.251485	8.169120	7.306683	5.5315400	4.94756	4.65997	4.65997
0.9	4.703687	4.462309	8.226300	7.804153	5.3790100	5.10298	4.61289	4.89271
1	4.659972	4.659972	8.303127	8.303127	5.2306400	5.23064	4.57363	5.11345

Note: [i] *Calculations assume values of A = 5, α = 0.4 and ε and λ both one.*

Table 2: The Effects of Prejudice on Interoccupational Wage Discrimination under Perfect Cmpetition

D	*MDC* (β=0.4)	*MDC* (β=0.5)	*MDC* (α=0.4)	*MDC* (α=0.5)	*MDC* (λ=1)	*MDC)* (λ=1.5	*MDC* (ε=1)	*MDC* (ε=1.5)
0.5	0.4142	0.3705	0.4142	0.4631	0.4142	0.3382	0.4142	0.5073
0.6	0.2910	0.2603	0.2910	0.3253	0.2910	0.2376	0.2910	0.3564
0.7	0.1952	0.1746	0.1952	0.2183	0.1952	0.1594	0.1952	0.2392
0.8	0.1180	0.1006	0.1180	0.1397	0.1180	0.0964	0.1180	0.1446
0.9	0.0541	0.0484	0.0541	0.0648	0.0541	0.0442	0.0541	0.0662
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: [i] *All calculations assume values of A = 5, p =2, F = 10. The second and third columns assume values of α = 0.4, λ = 1 and ε = 1, the fourth and fifth columns assume values of β = 0.4, λ = 1 and ε = 1, the sixth and seventh columns assume values of α = 0.4, β = 0.4 and ε = 1, and the last two columns assume values of α = 0.4, β = 0.4 and λ = 1.*

Table 3: The Effects of Prejudice on Employment, Wages and Discrimination

pA	*ϕ*	*α*	*β*	*D*	*M*	*N*	*MDC*
10	1	0.4	0.4	0.9	1.72	1.63	0.054
10	1	0.4	0.4	0.8	1.67	1.49	0.118
10	1	0.4	0.4	0.7	1.63	1.36	0.195
10	1	0.6	0.3	0.9	1.63	2.18	0.038
10	1	0.6	0.3	0.8	1.53	1.93	0.083
10	1	0.6	0.3	0.7	1.45	1.72	0.138
10	1	0.3	0.6	0.9	2.40	1.61	0.076
10	1	0.3	0.6	0.8	2.34	1.48	0.167
10	1	0.3	0.6	0.7	2.29	1.36	0.276

Table 4: The Effects of Majority / Minority Productivity Differences on Employment, Wages and Discrimination

pA	*ϕ*	*α*	*β*	*D*	*M*	*N*	*MDC*
10	1	0.7	0.1	0.9	2.61	0.94	0.143
10	1	0.6	0.2	0.9	2.25	1.23	0.094
10	1	0.5	0.3	0.9	1.99	1.45	0.069
10	1	0.4	0.4	0.9	1.72	1.63	0.054
10	1	0.3	0.5	0.9	1.48	1.82	0.042
10	1	0.2	0.6	0.9	1.24	2.03	0.031
10	1	0.1	0.7	0.9	0.915	2.30	0.02

Table 5: Wage Discrimination When Monopsony Power Varies

D	pA	$1/\phi$	MDC $\alpha = \beta = 0.4$	MDC $\alpha = 0.7$, $\beta = 0.1$	MDC $\alpha = 0.1$, $\beta = 0.7$
0.8	10	∞	0	0	0
0.8	10	10	0.0205	0.0245	0.0172
0.8	10	4	0.0456	0.0674	0.0309
0.8	10	2	0.0772	0.1477	0.0404
0.8	10	1	0.1180	0.3123	0.0446
0.8	10	0.5	0.1604	0.5869	0.0438
0.8	10	0.1	0.2249	1.6190	0.0383
0.8	10	0.04	0.2445	1.6477	0.0363
0.8	10	0.01	0.2472	1.6977	0.036
0.8	10	0.001	0.2497	1.7447	0.0357

Table 6: Descriptive Statistics: Hitters

	All (N =1093)		White (N =549)		Non-Whites (N = 544)	
Variable	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*
Personal Characteristics						
Log Annual Salary	13.890	1.13	13.865	1.10	13.914	1.16
Age	30.304	3.70	30.596	3.49	30.011	3.88
White	0.502	0.500	-	-	-	-
Non-White	0.498	0.500	-	-	-	-
Professional Characteristics						
MLB Experience	7.061	3.89	7.062	3.87	7.061	3.91
MLB Experience-Squared	64.957	69.31	64.785	70.06	65.131	68.61
Tenure with Current Club	2.673	3.00	3.062	3.38	2.279	2.50
Free Agent	0.600	0.49	0.598	0.49	0.603	0.49
Eligible for Final Offer Arbitration	0.296	0.46	0.304	0.46	0.287	0.45
American League	7.061	3.89	0.521	0.50	0.507	0.50
National League	0.486	0.50	0.479	0.50	0.493	0.50
Canadian Team	0.073	0.26	0.067	0.25	0.079	0.27
Performance						
At Bats	2506.414	2001.58	2419.738	1940.51	2593.888	2059.46
Stolen Bases	69.746	112.52	44.800	72.35	94.925	137.54
Bases on Balls	254.275	247.74	253.131	233.32	255.428	261.69
Total Bases	1060.200	913.52	1016.772	880.39	1104.028	944.57
Slugging Average	0.407	0.06	0.404	0.06	0.410	0.07
Batting Average	0.267	0.03	0.264	0.02	0.269	0.02
Infielder	0.459	0.50	0.556	0.50	0.362	0.48
Outfielder	0.383	0.49	0.217	0.41	0.552	0.50
Catcher	0.116	0.32	0.189	0.39	0.042	0.20
Designated Hitter	0.059	0.24	0.046	0.21	0.072	0.26
Greater Metro Area Characteristics						
Percentage White	80.507	6.89	80.938	6.77	80.073	6.99
Percentage Black	13.273	6.58	12.959	6.60	13.589	6.56
Percentage Hispanic	10.621	10.65	10.719	10.80	10.522	10.50
Average Annual Income ($)	25562.99	3789.65	25508.57	3757.99	25617.90	3824.001
PopulationA[1]	5514009	4657988	5313189	4509095	5716676	4799205
PopulationB[2]	4250564	2347840	4164763	2343188	4337153	2351506
Year Dummies						
1992	0.250	0.43	0.255	0.44	0.244	0.43
1993	0.235	0.42	0.248	0.44	0.222	0.42
1997	0.260	0.44	0.248	0.43	0.272	0.45
1998	0.255	0.44	0.250	0.43	0.260	0.44

Notes: 1. Population A denotes the greater metro area population; 2. Population B records the greater metro population for all MSAs except Chicago, New York and San Francisco teams – these were divided by two.
Source: All variables except Race and Greater Metro Area Characteristics (GMAC) extracted from the Lahman Baseball Database (Version 5.0, Release Date: Dec. 15, 2002). Race is derived form observed Topps Baseball Cards, years 92, 93, 94, 97, 99 (only years available). GMAC derived from the Statistical Abstract 1997-1999, the BEA, CA1-3, and from Statistical Canada.

Table 7: Descriptive Statistics: Pitchers

Variable	All (N =1204) Mean	All (N =1204) Std. Dev	White (N =948) Mean	White (N =948) Std. Dev	Black (N = 256) Mean	Black (N = 256) Std. Dev
Personal Characteristics						
Log Annual Salary	13.409	1.19	13.447	1.19	13.267	1.18
Age	29.815	4.09	30.214	4.05	28.336	3.90
White	0.787	0.41	-	-	-	-
Non-White	0.213	0.41	-	-	-	-
Professional Characteristics						
MLB Experience	5.988	4.2	6.153	4.30	5.375	4.16
MLB Experience-Squared	53.468	76.64	55.455	78.21	46.109	70.20
Tenure with Current Club	1.924	2.07	1.932	2.10	1.895	1.99
Free Agent	0.467	0.50	0.481	0.50	0.414	0.49
Eligible for Final Offer Arbitration	0.306	0.46	0.315	0.47	0.273	0.45
American League	0.513	0.50	0.519	0.50	0.492	0.50
National League	0.487	0.50	0.481	0.50	0.508	0.50
Canadian Team	0.069	0.25	0.062	0.24	0.094	0.29
Starter	0.442	0.50	0.438	0.50	0.457	0.50
Performance						
Wins	37.446	44.33	38.811	45.19	32.391	40.66
Losses	34.179	37.05	35.734	38.31	28.418	31.34
Games Started	74.12	105.53	77.276	108.36	62.43	93.54
Complete Games	10.15	22.24	10.911	23.28	7.328	17.65
Shutouts	2.875	6.08	3.045	6.31	2.242	5.105
Saves	19.488	51.87	20.831	52.78	14.516	48.145
Homeruns	56.517	62.57	58.573	64.35	48.906	54.919
Walks	225.779	249.73	230.824	257.16	207.098	219.491
Strikeouts	436.641	514.13	448.76	529.17	391.766	452.215
Innings Pitched	627.59	702.43	652.231	719.53	536.344	628.07
ERA	4.025	0.96	3.998	0.94	4.124	1.027
Strikeout Rate	0.078	0.02	0.078	0.02	0.080	0.019
Greater Metro Area Characteristics						
Percentage White	80.714	6.84	80.723	6.91	0.081	0.02
Percentage Black	13.038	6.46	12.936	6.50	80.68	6.56
Percentage Hispanic	10.975	10.77	10.853	10.59	13.416	6.327
Average Annual Income ($)	25488.2	3939.85	25499.05	3887.87	11.429	11.42
PopulationA[1]	5551948	4683875	5472495	4620212	5846175	4910606
PopulationB[2]	4230164	2347488	4183045	2305216	4404650	2494775
Year Dummies						
1992	0.221	0.42	0.24	0.424	0.17	0.38
1993	0.239	0.43	0.25	0.432	0.22	0.41
1997	0.264	0.44	0.26	0.436	0.30	0.46
1998	0.276	0.45	0.26	0.440	0.33	0.47

Notes: 1. Population A denotes the greater metro area population; 2. Population B records the greater metro population for all MSAs except Chicago, New York and San Francisco teams – these were divided by two.
Source: All variables except Race and Greater Metro Area Characteristics (GMAC) extracted from the Lahman Baseball Database (Version 5.0, Release Date: Dec. 15, 2002). Race is derived form observed Topps Baseball Cards, years 92, 93, 94, 97, 99 (only years available). GMAC derived from the Statistical Abstract 1997-1999, the BEA, CA1-3, and from Statistical Canada.

Table 8: Log Annual Salary – Hitters

	(1) All		(2) White		(3) Non-White		(4) Early Period		(5) Latter Period		Compt. (6)		Non-Compt (7)	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics														
Age	-0.048	-4.13	-0.065	-3.77	-0.027	-1.69	-0.021	-1.19	-0.064	-4.19	-0.049	-3.70	-0.019	-1.30
Non-White	-0.003	-0.06	-	-	-	-	0.068	1.15	-0.082	-1.49	0.011	0.25	0.030	0.55
Professional Characteristics														
MLB Experience	0.320	8.99	0.355	7.26	0.298	5.63	0.206	3.92	0.433	8.86	0.409	15.33	-	-
MLB Experience-Squared	-0.021	-13.93	-0.021	-9.99	-0.023	-9.74	-0.017	-8.07	-0.027	-11.82	-0.025	-20.44	0.017	0.66
Tenure with Current Club	0.043	6.53	0.034	3.81	0.049	4.58	0.042	4.58	0.046	4.84	0.044	6.42	-0.011	-0.23
Free Agent	0.632	4.72	0.458	2.41	0.741	3.90	0.855	4.42	0.320	1.73	-	-	-	-
Eligible for Final Offer Arbitration	0.365	4.30	0.338	2.74	0.374	3.18	0.521	4.26	0.148	1.27	-	-	-	-
American League	-0.061	-1.53	-0.130	-2.29	-0.025	-0.45	-0.009	-0.15	-0.0589	-1.08	-0.098	-2.24	0.034	0.64
Canadian Team	-0.065	-0.46	-0.219	-1.10	0.066	0.32	-0.315	-1.50	-0.151	-0.59	0.003	0.02	-0.733	-3.90
Career Characteristics														
At Bats	2.00-4	2.65	0.000	1.04	2.00-4	2.43	0.000	1.97	0.000	3.13	0.000	3.15	-0.002	-2.93
Stolen Bases	0.001	4.26	0.001	2.25	0.001	3.30	0.001	1.84	0.002	4.72	0.001	4.04	0.001	0.59
Bases on Balls	0.000	0.69	0.000	-0.09	0.000	1.79	0.000	0.86	-0.000	-0.08	0.000	0.73	0.001	0.74
Total Bases	0.000	1.44	0.000	1.36	0.000	0.80	0.000	0.86	-0.000	-0.12	0.000	0.48	0.008	4.01
Slugging Average	4.215	7.36	4.429	5.07	3.836	5.01	4.028	5.02	5.155	6.21	5.042	7.58	-2.174	-2.01
Batting Average	3.435	3.27	0.910	0.62	5.979	3.87	4.095	2.79	2.235	1.50	3.135	2.65	2.573	2.06
Infielder	0.027	0.17	-0.256	-0.94	0.072	0.36	0.270	1.09	-0.526	-1.27	0.010	0.06	0.058	0.99
Outfielder	-0.113	-0.71	-0.385	-1.39	-0.088	-0.44	0.166	0.67	-0.685	-1.65	-0.147	-0.88	-	-
Catcher	0.305	1.83	-0.026	-0.09	0.509	2.17	0.613	2.38	-0.300	-0.72	0.315	1.78	-.0125	0.12
Designated Hitter	0.047	0.35	-0.198	-0.77	0.157	0.98	0.117	0.78	-0.476	-1.15	0.052	0.36	-0.293	-0.99
Greater Metro Area Characteristics														
Percentage White	0.004	0.79	0.002	0.27	0.003	0.43	-0.016	-1.51	0.006	0.81	0.005	0.87	-0.003	-0.46
Percentage Black	0.008	1.47	0.009	1.08	0.007	0.93	-0.014	-1.29	0.008	1.08	0.009	1.53	-0.013	-1.56
Percentage Hispanic	0.002	1.02	0.005	1.43	-0.001	-0.43	-0.008	-2.07	0.007	2.29	0.003	0.99	-0.001	-0.43
Average Income	0.000	0.87	0.000	0.50	0.000	0.97	-0.000	-1.57	0.000	0.43	0.000	1.09	-0.000	-1.87
Population	0.000	-0.32	0.000	-0.39	0.000	-0.03	0.000	1.32	0.000	0.26	0.000	-0.24	0.000	1.31
Year Dummies														
1993	0.068	1.31	0.047	0.64	0.089	1.21	0.119	2.09	-	-	0.080	1.41	0.040	2.54
1997	0.129	1.89	0.185	1.87	0.054	0.57	-	-	-	-	0.128	1.69	-0.007	1.91
1998	0.208	2.69	0.209	1.83	0.176	1.66	-	-	0.088	1.71	0.197	2.31	0.198	3.85
Constant	9.556	12.23	11.038	9.38	8.461	8.03	11.735	7.41	10.237	8.93	9.269	10.44	11.370	13.50
Adjusted R-Squared	0.7317		0.7128		0.7567		0.6938		0.7722		0.6589		0.6925	
F-Statistic	111.30 (27, 1065)		53.32 (26, 552)		65.95 (26, 517)		48.94 (25, 504)		77.22 (25, 537)		76.56 (25, 953)		12.06 (23, 90)	
Root Mean Squared Error	0.58448		0.58932		0.57075		0.58681		0.55981		0.60836		0.2428	
Observations	1093		549		544		530		563		979		114	

Notes: 1. Early (Latter) Period denotes 1992 and 1993 (1997 and 1998); 2. (Non-) Compt refers to Hitters who are (neither) Free Agents or (nor) Eligible for Final Offer Arbitration

Table 9:Log Annual Salary – Pitchers

	(1) All		(2) White		(3) Non-Whites		(4) Early Period		(5) Latter Period		(6) Compt.		(7) Non-Compt.	
	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat
Personal Characteristics														
Age	0.003	0.28	0.014	1.32	-0.052	-2.37	-0.011	-0.76	0.007	0.60	-0.0229	-1.99	0.025	2.59
Non-White	0.011	0.26	-	-	-	-	-0.155	-2.28	0.073	1.34	-0.073	-1.33	0.119	3.05
Professional Characteristics														
MLB Experience	0.152	5.20	0.179	5.64	0.154	2.01	0.216	4.83	0.154	3.59	0.275	11.61	0.000	0.00
MLB Experience-Squared	-0.014	-12.30	-0.014	-11.58	-0.021	-6.34	-0.015	-8.63	-0.016	-9.00	-0.017	-17.54	-0.0135	-0.87
Tenure with Current Club	0.068	7.86	0.064	6.78	0.066	3.22	0.069	5.39	0.064	5.38	0.063	6.67	-0.013	-0.42
Free Agent	0.748	6.60	0.753	6.09	0.481	1.71	0.760	4.42	0.574	3.61	-	-	-	-
Eligible for Final Offer Arbitration	0.427	6.44	0.463	6.31	0.18	1.20	0.442	4.33	0.318	3.46	-	-	-	-
American League	0.009	0.24	0.024	0.62	0.027	0.32	-0.018	-0.33	-0.001	-0.01	-0.033	-0.76	0.047	1.22
Canadian Team	0.027	0.21	0.017	0.12	-0.154	-0.58	-0.146	-0.80	0.004	0.02	-0.078	-0.47	-0.022	-0.18
Career Characteristics														
Starter	0.385	8.31	0.386	7.49	0.426	4.34	0.387	5.83	0.370	5.66	0.485	8.09	0.107	1.74
Wins	0.009	2.60	0.006	1.58	0.039	4.59	0.010	2.08	0.012	2.43	0.009	2.33	0.016	2.01
Losses	0.005	1.43	0.004	0.97	0.012	1.57	0.007	1.47	0.003	0.51	0.007	1.94	-0.010	-1.16
Games Started	-0.003	-2.70	0.001	-0.82	-0.012	-4.54	-0.003	-2.06	-0.003	-1.76	-0.003	-1.96	-0.012	-2.57
Complete Games	0.001	0.42	0.002	0.53	-0.019	-1.93	0.006	1.66	-0.008	-1.43	0.005	1.40	0.020	0.83
Shutouts	-0.047	-4.48	-0.057	-5.05	0.005	0.20	-0.049	-3.42	-0.040	-2.53	-0.047	-4.16	-0.014	-0.35
Saves	0.003	4.63	0.003	4.81	0.000	0.34	0.001	1.32	0.004	5.31	0.002	3.62	0.010	2.36
Homeruns	-0.005	-4.64	-0.006	-4.72	-0.005	-1.41	-0.007	-3.89	-0.003	-1.74	-0.003	-2.61	-0.002	-0.55
Walks	-0.000	-1.15	-0.001	-1.90	0.000	0.09	-0.001	-1.47	-0.001	-1.29	0.000	0.00	-0.001	-0.86
Strikeouts	0.001	2.75	0.001	4.29	-0.002	-3.23	0.001	2.77	0.000	0.06	0.001	2.78	0.002	1.35
Innings Pitched	0.001	3.30	0.001	2.56	0.002	2.16	0.001	1.70	0.002	2.79	0.001	1.21	0.004	2.40
ERA	-0.133	-6.11	-0.146	-5.93	-0.037	-0.82	-0.150	-4.13	-0.121	-4.33	-0.329	-8.72	0.018	1.09
Strikeout Rate	5.562	4.59	5.749	4.19	8.624	3.30	6.663	3.17	5.644	3.57	3.970	2.37	1.564	1.13
Greater Metro Area Characteristics														
Percentage White	0.001	0.22	0.002	0.37	-0.002	-0.18	-0.010	-1.08	0.004	0.62	0.000	0.03	-0.005	-0.97
Percentage Black	0.004	0.84	0.005	0.95	0.006	0.56	-0.002	-0.23	0.003	0.45	0.004	0.67	-0.001	-0.18
Percentage Hispanic	0.005	2.60	0.005	2.16	0.007	1.50	0.003	0.98	0.006	2.16	0.003	1.28	0.004	1.89
Average Income	0.000	0.52	0.000	0.48	0.000	0.45	0.000	-0.37	0.000	0.24	0.000	0.90	0.000	-0.73
Population	0.000	0.67	0.000	0.89	-0.000	-0.34	0.000	-0.28	0.000	1.30	0.000	0.07	0.000	0.34
Year Dummies														
1993	0.011	0.22	0.034	0.78	0.112	0.97	0.0232	0.48	-	-	0.028	0.48	-0.012	-0.23
1997	0.140	2.17	0.121	1.69	0.091	0.63	-	-	-	-	0.173	2.16	0.206	3.05
1998	0.267	3.75	0.202	2.54	0.305	1.91	-	-	0.126	2.73	0.283	3.16	0.417	5.81
Constant	11.314	16.90	11.505	15.41	9.412	6.45	12.779	9.28	10.922	10.59	12.894	15.14	11.252	16.54
Adjusted R-Squared	0.7787		0.7906		0.7790		0.7873		0.7832		0.6953		0.6146	
F-Statistic	141.99 $_{(30, 1172)}$		124.15 $_{(29, 917)}$		31.99 $_{(29, 226)}$		73.96 $_{(28, 524)}$		84.74 $_{(28, 621)}$		76.78 $_{(28, 902)}$		41 78 $_{(27, 244)}$	
Root Mean Squared Error	0.56095		0.54624		0.55437		0.55815		0. 54845		59851		0.27321	
Observations	1203		947		256		553		650		931		272	

Notes: 1. Early (Latter) Period denotes 1992 and 1993 (1997 and 1998); 2. (Non-) Compt refers to Hitters who are (neither) Free Agents or (nor) Eligible for Final Offer Arbitration

Table 10: Interoccupational Pay Discrimination Controlling for Position Specific Productivity

	(1) All Default – White Pitcher		*(2) All Default – Non-White Pitcher*		*(3) All Default – White Hitter*		*(4) All Default – Non-White Hitter*	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics								
Age	-0.026	-3.44	-0.026	-3.44	-0.026	-3.44	-0.026	-3.44
Position Specific Productivity	0.861	37.61	0.861	37.61	0.861	37.61	0.861	37.61
White Pitcher	-	-	**0.086**	**1.92**	**0.171**	**5.00**	**0.103**	**2.98**
Non-White Pitcher	**-0.086**	**-1.92**	-	-	**0.086**	**1.76**	**0.018**	**0.37**
White Hitter	**-0.171**	**-5.00**	**-0.086**	**-1.76**	-	-	**-0.068**	**-1.80**
Non-White Hitter	**-0.103**	**-2.98**	**-0.018**	**-0.37**	**0.068**	**1.80**	-	-
Professional Characteristics								
MLB Experience	0.152	6.80	0.152	6.80	0.152	6.80	0.152	6.80
MLB Experience-Squared	-0.010	-11.51	-0.010	-11.51	-0.010	-11.51	-0.010	-11.51
Tenure with Current Club	0.056	10.40	0.056	10.40	0.056	10.40	0.056	10.40
Free Agent	0.886	9.94	0.886	9.94	0.886	9.94	0.886	9.94
Eligible for Final Offer Arbitration	0.475	8.79	0.475	8.79	0.475	8.79	0.475	8.79
American League	-0.006	-0.23	-0.006	-0.23	-0.006	-0.23	-0.006	-0.23
Canadian Team	-0.020	-0.19	-0.020	-0.19	-0.020	-0.19	-0.020	-0.19
Greater Metro Area Characteristics								
Percentage White	0.001	0.34	0.001	0.34	0.001	0.34	0.001	0.34
Percentage Black	0.005	1.15	0.005	1.15	0.005	1.15	0.005	1.15
Percentage Hispanic	0.005	3.35	0.005	3.35	0.005	3.35	0.005	3.35
Average Income	0.000	1.33	0.000	1.33	0.000	1.33	0.000	1.33
Population A	0.000	0.18	0.000	0.18	0.000	0.18	0.000	0.18
Year Dummies								
1993	0.050	1.34	0.050	1.34	0.050	1.34	0.050	1.34
1997	0.052	1.07	0.052	1.07	0.052	1.07	0.052	1.07
1998	0.137	2.52	0.137	2.52	0.137	2.52	0.137	2.52
Constant	1.068	1.77	0.982	1.63	0.900	1.48	0.964	1.59
Adjusted R-Squared	0.7328		0.7328		0.7328		0.7328	
F-Statistic	$315.53_{20, 2274}$		$315.53_{20, 2274}$		$315.53_{20, 2274}$		$315.53_{20, 2274}$	
Root Mean Squared Error	0.61351		0.61351		0.61351		0.61351	
Observations	2295		2295		2295		2295	

Table 11: Competitive and Non-Competitive Discrimination with Position Specific Productivity

	Competitive								*Non-Competitive*							
	(1) All Default – White Pitcher		*(2) All Default – Non-White Pitcher*		*(3) All Default – White Hitter*		*(4) All Default – Non-White Hitter*		*(5) All Default – White Pitcher*		*(6) All Default – Non-White Pitcher*		*(7) All Default – White Hitter*		*(8) All Default – Non-White Hitter*	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics																
Age	0.006	0.61	0.006	0.61	0.006	0.61	0.006	0.61	-0.038	-4.27	-0.038	-4.27	-0.038	-4.27	-0.038	-4.27
Position Specific Productivity	0.417	9.98	0.417	9.98	0.417	9.98	0.417	9.98	0.910	35.48	0.910	35.48	0.910	35.48	0.910	35.48
White Pitcher	**-**	**-**	**-0.151**	**-3.28**	**0.020**	**0.36**	**-0.015**	**-0.27**	**-**	**-**	**0.189**	**3.34**	**0.183**	**4.70**	**0.115**	**2.90**
Non-White Pitcher	**0.151**	**3.28**	**-**	**-**	**0.171**	**2.71**	**0.136**	**2.20**	**-0.189**	**-3.34**	**-**	**-**	**-0.005**	**-0.09**	**-0.074**	**-1.26**
White Hitter	**-0.020**	**-0.36**	**-0.171**	**-2.71**	**-**	**-**	**-0.035**	**-0.56**	**-0.183**	**-4.70**	**0.005**	**0.09**	**-**	**-**	**-0.069**	**-1.62**
Non-White Hitter	**0.015**	**0.27**	**-0.136**	**-2.20**	**0.035**	**0.56**	**-**	**-**	**-0.115**	**-2.90**	**0.074**	**1.26**	**0.069**	**1.62**	**-**	**-**
Constant	6.093	7.14	6.244	7.33	6.072	7.00	6.108	7.07	0.770	1.09	0.581	0.83	0.586	0.83	0.655	0.93
Adjusted R-Squared	0.4030		0.4030		0.4030		0.4030		0.6299		0.6299		0.6299		0.6299	
F-Statistic	16.29 $_{(17, 368)}$		16.29 $_{(17, 368)}$		16.29 $_{(17, 368)}$		16.29 $_{(17, 368)}$		181.40 $_{(18, 1890)}$		181.40 $_{(18, 1890)}$		181.40 $_{(18, 1890)}$		181.40 $_{(18, 1890)}$	
Root Mean Squared Error	0.33421		0.33421		0.33421		0.33421		0.65236		0.65236		0.65236		0.65236	
Observations	386		386		386		386		1909		1909		1909		1909	

Note: 1. Other explanatory regressors were those set out in Table 10; 2. (*Non-*) *Compt* refers to Hitters who are (neither) *Free Agents* or (nor) *Eligible for Final Offer Arbitration*

Table 12: Discrimination across Time with Position Specific Productivity

	Early Period								*Latter Period*							
	(1) All Default – White Pitcher		*(2) All Default – Non-White Pitcher*		*(3) All Default – White Hitter*		*(4) All Default – Non-White Hitter*		*(5) All Default – White Pitcher*		*(6) All Default – Non-White Pitcher*		*(7) All Default – White Hitter*		*(8) All Default – Non-White Hitter*	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics																
Age	-0.029	-2.48	-0.029	-2.48	-0.029	-2.48	-0.029	-2.48	-0.020	-2.03	-0.020	-2.03	-0.020	-2.03	-0.020	-2.03
Position Specific Productivity	0.817	22.58	0.817	22.58	0.817	22.58	0.817	22.58	0.897	30.47	0.897	30.47	0.897	30.47	0.897	30.47
White Pitcher	**-**	**-**	**0.234**	**3.25**	**0.219**	**4.37**	**0.106**	**2.05**	**-**	**-**	**-0.023**	**-0.41**	**0.124**	**2.64**	**0.102**	**2.18**
Non-White Pitcher	**-0.234**	**-3.25**	**-**	**-**	**-0.015**	**-0.20**	**-0.129**	**-1.67**	**0.023**	**0.41**	**-**	**-**	**0.148**	**2.36**	**0.125**	**2.06**
White Hitter	**-0.219**	**-4.37**	**0.015**	**0.20**	**-**	**-**	**-0.113**	**-2.04**	**-0.124**	**-2.64**	**-0.148**	**-2.36**	**-**	**-**	**-0.023**	**-0.44**
Non-White Hitter	**-0.106**	**-2.05**	**0.129**	**1.67**	**0.113**	**2.04**	**-**	**-**	**-0.102**	**-2.18**	**-0.125**	**-2.06**	**0.023**	**0.44**	**-**	**-**
Constant	3.541	3.06	3.307	2.86	3.322	2.05	3.436	2.95	-0.140	-0.17	-0.117	-0.14	-0.265	-0.31	-0.242	-0.29
Adjusted R-Squared	0.7054		0.7054		0.7054		0.7054		0.7585		0.7585		0.7585		0.7585	
F-Statistic	153.27 $_{(17, 1064)}$		153.27 $_{(17, 1064)}$		153.27 $_{(17, 1064)}$		153.27 $_{(17, 1064)}$		224.97$_{(17, 1195)}$		224.97$_{(17, 1195)}$		224.97$_{(17, 1195)}$		224.97$_{(17, 1195)}$	
Root Mean Squared Error	0.62568		0.62568		0.62568		0.62568		0.59602		0.59602		0.59602		0.59602	
Observations	1082		1082		1082		1082		1213		1213		1213		1213	

Note: 1. Other explanatory regressors were those set out in Tables 10; 2. Early (Latter) Period denotes 1992 and 1993 (1997 and 1998);

Table 13: Competitive Discrimination Across Time with Position Specific Productivity

	Early Period								*Latter Period*							
	(1) All Default – White Pitcher		*(2) All Default – Non-White Pitcher*		*(3) All Default – White Hitter*		*(4) All Default – Non-White Hitter*		*(5) All Default – White Pitcher*		*(6) All Default – Non-White Pitcher*		*(7) All Default – White Hitter*		*(8) All Default – Non-White Hitter*	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics																
Age	-0.012	-1.00	-0.012	-1.00	-0.012	-1.00	-0.012	-1.00	0.016	1.20	0.016	1.20	0.016	1.20	0.016	1.20
Position Specific Productivity	0.443	7.53	0.443	7.53	0.443	7.53	0.443	7.53	0.429	7.26	0.429	7.26	0.429	7.26	0.429	7.26
White Pitcher	-	-	**-0.045**	**-0.72**	**-0.099**	**-1.55**	**-0.080**	**-1.16**	-	-	**-0.190**	**-2.87**	**0.088**	**0.91**	**0.030**	**0.36**
Non-White Pitcher	**0.045**	**0.72**	-	-	**-0.054**	**-0.69**	**-0.035**	**-0.43**	**0.190**	**2.87**	-	-	**0.278**	**2.71**	**0.220**	**2.48**
White Hitter	**0.099**	**1.55**	**0.054**	**0.69**	-	-	**0.019**	**0.25**	**-0.088**	**-0.91**	**-0.278**	**-2.71**	-	-	**-0.058**	**-0.56**
Non-White Hitter	**0.080**	**1.16**	**0.035**	**0.43**	**-0.019**	**-0.25**	-	-	**-0.030**	**-0.36**	**-0.220**	**-2.48**	**0.058**	**0.56**	-	-
Constant	8.612	6.07	8.656	6.13	8.711	6.07	8.692	6.06	5.644	4.23	5.834	4.39	5.556	4.09	5.614	4.17
Adjusted R-Squared	0.4512		0.4512		0.4512		0.4512		0.3041		0.3041		0.3041		0.3041	
F-Statistic	$11.63_{(14, 167)}$		$11.63_{(14, 167)}$		$11.63_{(14, 167)}$		$11.63_{(14, 167)}$		$7.34_{(14, 189)}$		$7.34_{(14, 189)}$		$7.34_{(14, 189)}$		$7.34_{(14, 189)}$	
Root Mean Squared Error	0.2816		0.2816		0.2816		0.2816		0.36797		0.36797		0.36797		0.36797	
Observations	182		182		182		182		204		204		204		204	

Note: 1. Other explanatory regressors were those set out in Tables 10; 2. Competitive Discrimination refers to refers to players who are *Free Agents* or *Eligible for Final Offer Arbitration; 3. Early (Latter) Period denotes 1992 and 1993 (1997 and 1998);*

Table 14: Non-Competitive Discrimination across Time with Position Specific Productivity

	Early Period								*Latter Period*							
	(1) All Default – White Pitcher		*(2) All Default – Non-White Pitcher*		*(3) All Default – White Hitter*		*(4) All Default – Non-White Hitter*		*(5) All Default – White Pitcher*		*(6) All Default – Non-White Pitcher*		*(7) All Default – White Hitter*		*(8) All Default – Non-White Hitter*	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics																
Age	-0.040	2.89	-0.040	2.89	-0.040	2.89	-0.040	2.89	-0.031	-2.75	-0.031	-2.75	-0.031	-2.75	-0.031	-2.75
Position Specific Productivity	0.858	20.80	0.858	20.80	0.858	20.80	0.858	20.80	0.951	29.39	0.951	29.39	0.951	29.39	0.951	29.39
White Pitcher	-	-	**0.354**	**3.82**	**0.266**	**4.53**	**0.138**	**2.29**	-	-	**0.054**	**0.77**	**0.106**	**2.04**	**0.092**	**1.75**
Non-White Pitcher	**-0.354**	**-3.82**	-	-	**-0.088**	**-0.91**	**-0.217**	**-2.26**	**-0.054**	**-0.77**	-	-	**0.052**	**0.70**	**0.038**	**0.52**
White Hitter	**-0.266**	**-4.53**	**0.088**	**0.91**	-	-	**-0.129**	**-2.01**	**-0.106**	**-2.04**	**-0.052**	**-0.70**	-	-	**-0.014**	**-0.25**
Non-White Hitter	**-0.138**	**-2.29**	**0.217**	**2.26**	**0.129**	**2.01**	-	-	**-0.092**	**-1.75**	**-0.038**	**-0.52**	**0.014**	**0.25**	-	-
Constant	3.2712	2.38	2.917	2.13	3.005	2.17	3.134	2.27	-0.598	-0.62	-0.652	-0.67	-0.704	-0.72	-0.690	-0.71
Adjusted R-Squared	0.5464		0.5464		0.5464		0.5464		0.7010		0.7010		0.7010		0.7010	
F-Statistic	$73.19_{(15, 884)}$		$73.19_{(15, 884)}$		$73.19_{(15, 884)}$		$73.19_{(15, 884)}$		$155.18_{(15, 993)}$		$155.18_{(15, 993)}$		$155.18_{(15, 993)}$		$155.18_{(15, 993)}$	
Root Mean Squared Error	0.67979		0.67979		0.67979		0.67979		0.61875		0.61875		0.61875		0.61875	
Observations	900		900		900		900		1009		1009		1009		1009	

Note: 1. Other explanatory regressors were those set out in Tables 10; 2. Non-Competitive Discrimination refers to players who are neither *Free Agents* nor *Eligible for Final Offer Arbitration; 3. Early (Latter) Period denotes 1992 and 1993 (1997 and 1998);*

Table 15: Customer Discrimination with Position Specific Productivity

	Below Average Greater Metro Area Non-White Population								*Above Average Greater Metro Area Non-White Population*							
	(1) All Default – White Pitcher		*(2) All Default – Non-White Pitcher*		*(3) All Default – White Hitter*		*(4) All Default – Non-White Hitter*		*(5) All Default – White Pitcher*		*(6) All Default – Non-White Pitcher*		*(7) All Default – White Hitter*		*(8) All Default – Non-White Hitter*	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics																
Age	-0.020	-1.86	-0.020	-1.86	-0.020	-1.86	-0.020	-1.86	-0.027	-2.62	-0.027	-2.62	-0.027	-2.62	-0.027	-2.62
Position Specific Productivity	0.887	26.88	0.887	26.88	0.887	26.88	0.887	26.88	0.836	26.68	0.836	26.68	0.836	26.68	0.836	26.68
White Pitcher	**-**	**-**	**0.034**	**0.53**	**0.186**	**3.87**	**0.030**	**0.60**	**-**	**-**	**0.113**	**1.83**	**0.156**	**3.23**	**0.182**	**3.83**
Non-White Pitcher	**-0.034**	**-0.53**	**-**	**-**	**0.152**	**2.20**	**-0.004**	**-0.06**	**-0.113**	**-1.83**	**-**	**-**	**0.042**	**0.63**	**0.068**	**1.04**
White Hitter	**-0.186**	**-3.87**	**-0.152**	**-2.20**	**-**	**-**	**-0.156**	**-2.92**	**-0.156**	**-3.23**	**-0.042**	**-0.63**	**-**	**-**	**0.026**	**0.49**
Non-White Hitter	**-0.030**	**-0.60**	**0.004**	**0.06**	**0.156**	**2.92**	**-**	**-**	**-0.182**	**-3.83**	**-0.068**	**-1.04**	**-0.026**	**-0.49**	**-**	**-**
Constant	0.035	0.03	0.001	0.00	-0.151	-0.12	0.000	0.00	0.129	0.13	0.015	0.02	-0.027	-0.03	-0.053	-0.05
Adjusted R-Squared	0.7266		0.7266		0.7266		0.7266		0.7490		0.7490		0.7490		0.7490	
F-Statistic	$155.52_{(20, 1143)}$		$155.52_{(20, 1143)}$		$155.52_{(20, 1143)}$		$155.52_{(20, 1143)}$		$169.57_{(20, 1110)}$		$169.57_{(20, 1110)}$		$169.57_{(20, 1110)}$		$169.57_{(20, 1110)}$	
Root Mean Squared Error	0.61623		0.61623		0.61623		0.61623		0.59675		0.59675		0.59675		0.59675	
Observations	1164		1164		1164		1164		1131		1131		1131		1131	

Note: 1. Other explanatory regressors were those set out in Table 10; 2. Competitive Discrimination refers to refers to players who are *Free Agents* or *Eligible for Final Offer Arbitration;*

Table 16: Competitive Customer Discrimination with Position Specific Productivity

	Below Average Greater Metro Area Non-White Population								Above Average Greater Metro Area Non-White Population							
	(1) All Default – White Pitcher		(2) All Default – Non-White Pitcher		(3) All Default – White Hitter		(4) All Default – Non-White Hitter		(5) All Default – White Pitcher		(6) All Default – Non-White Pitcher		(7) All Default – White Hitter		(8) All Default – Non-White Hitter	
	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat
Personal Characteristics	-0.009	-0.74	-0.009	-0.74	-0.009	-0.74	-0.009	-0.74	0.027	1.70	0.027	1.70	0.027	1.70	0.027	1.70
Age																
Position Specific Productivity	0.261	4.77	0.261	4.77	0.261	4.77	0.261	4.77	0.507	8.10	0.507	8.10	0.507	8.10	0.507	8.10
White Pitcher	-	-	-0.078	-1.36	-0.039	-0.58	-0.169	-2.46	-	-	-0.139	-1.90	0.056	0.61	0.096	1.10
Non-White Pitcher	0.078	1.36	-	-	0.039	0.48	-0.091	-1.11	0.139	1.90	-	-	0.194	1.99	0.235	2.52
White Hitter	0.039	0.58	-0.039	-0.48	-	-	-0.130	-1.62	-0.056	-0.61	-0.194	-1.99	-	-	0.040	0.40
Non-White Hitter	0.169	2.46	0.091	1.11	0.130	1.62	-	-	-0.096	-1.10	-0.235	-2.52	-0.040	-0.40	-	-
Constant	8.228	4.91	8.306	4.98	8.267	4.91	8.306	4.98	2.559	1.58	2.697	1.66	2.503	1.53	2.462	1.52
Adjusted R-Squared	0.4224		0.4224		0.4224		0.4224		0.4053		0.4053		0.4053		0.4053	
F-Statistic	9.39 (17, 178)		9.39 (17, 178)		9.39 (17, 178)		9.39 (17, 178)		8.58 (17, 172)		8.58 (17, 172)		8.58 (17, 172)		8.58 (17, 172)	
Root Mean Squared Error	0.28431		0.28431		0.28431		0.28431		0.36948		0.36948		0.36948		0.36948	
Observations	196		196		196		196		190		190		190		190	

Note: 1. Other explanatory regressors were those set out in Table 10; 2. Competitive Discrimination refers to players who are *Free Agents* or *Eligible for Final Offer Arbitration*

Table 17: Non-Competitive Customer Discrimination with Position Specific Productivity

	Below Average Greater Metro Area Non-White Population								Above Average Greater Metro Area Non-White Population							
	(1) All Default – White Pitcher		(2) All Default – Non-White Pitcher		(3) All Default – White Hitter		(4) All Default – Non-White Hitter		(5) All Default – White Pitcher		(6) All Default – Non-White Pitcher		(7) All Default – White Hitter		(8) All Default – Non-White Hitter	
	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat
Personal Characteristics																
Age	-0.034	-2.63	-0.034	-2.63	-0.034	-2.63	-0.034	-2.63	-0.039	-3.28	-0.039	-3.28	-0.039	-3.28	-0.039	-3.28
Position Specific Productivity	0.940	25.46	0.940	25.46	0.940	25.46	0.940	25.46	0.883	25.27	0.883	25.27	0.883	25.27	0.883	25.27
White Pitcher	-	-	0.141	1.75	0.225	4.10	0.053	0.93	-	-	0.205	2.63	0.145	2.68	0.187	3.48
Non-White Pitcher	-0.141	-1.75	-	-	0.084	1.01	-0.088	-1.05	-0.205	-2.63	-	-	-0.059	-0.72	-0.018	-0.22
White Hitter	-0.225	-4.10	-0.084	-1.01	-	-	-0.172	-2.85	-0.145	-2.68	0.059	0.72	-	-	0.042	0.70
Non-White Hitter	-0.053	-0.93	0.088	1.05	0.172	2.85	-	-	-0.187	-3.48	0.018	0.22	-0.042	-0.70	-	-
Constant	-0.500	-0.35	-0.641	-0.45	-0.725	-0.50	-0.553	-0.38	0.371	0.32	0.166	0.14	0.226	0.19	0.184	0.16
Adjusted R-Squared	0.6212		0.6212		0.6212		0.6212		0.6550		0.6550		0.6550		0.6550	
F-Statistic	89.11 (18, 949)		89.11 (18, 949)		89.11 (18, 949)		89.11 (18, 949)		100.13 (18, 922)		100.13 (18, 922)		100.13 (18, 922)		100.13 (18, 922)	
Root Mean Squared Error	0.6589		0.6589		0.6589		0.6589		0. 62784		0. 62784		0. 62784		0. 62784	
Observations	968		968		968		968		941		941		941		941	

Note: Other explanatory regressors were those set out in Table 10; 2. Non-Competitive Discrimination refers to players who are neither *Free Agents* nor *Eligible for Final Offer Arbitration;*

Table 18: Interoccupational Pay Discrimination Controlling for Position Specific Productivity and Relative Productivity

	(1) White Pitchers / Non-White Hitters		*(2) Non-White Pitchers / White Hitters*		*(3) White Hitters / Non-White Pitchers*		*(4) Non-White Hitters / White Pitchers*	
	Coef	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*	*Coef*	*T-Stat*
Personal Characteristics								
Age	-0.030	-3.43	-0.011	-0.82	-0.011	-0.83	-0.030	-3.43
Position Specific Productivity	0.900	24.11	0.886	19.09	0.757	15.51	0.860	27.59
White Pitcher	**0.401**	**1.77**	-	-	-	-	-	-
Non-White Pitcher	-	-	**0.843**	**2.62**	-	-	-	-
White Hitter	-	-	-	-	**-0.885**	**-2.55**	-	-
Non-White Hitter	-	-	-	-	-	-	**-0.256**	**-1.32**
Relative Productivity								
White Pitcher: Non-White Hitter	**-0.002**	**-1.27**	-	-	-	-	-	-
Non-White Pitcher: White Hitter	-	-	**-0.005**	**-2.42**	-	-	-	-
White Hitter: Non-White Pitcher	-	-	-	-	**0.005**	**2.36**		
Non-White Hitter: White Pitcher	-	-	-	-	-	-	**0.001**	**0.74**
Constant	0.396	0.49	-0.099	-0.09	1.729	1.52	1.066	1.42
Adjusted R-Squared	0.7473		0.7154		0.7153		0.7471	
F-Statistic	232.87 $_{(19, 1471)}$		107.26 $_{(19, 784)}$		107.21 $_{(19, 784)}$		232.64 $_{(19, 1471)}$	
Root Mean Squared Error	0.60385		0. 61859		0.61870		0.60407	
Observations	1491		804		804		1491	

Notes: 1. Other explanatory regressors were those set out in Table 10; 2. 'Relative Productivity' is defined as, e.g., 'White Pitcher: Non-White Hitter' = Individual White Pitcher Productivity x (Individual White Pitcher Productivity - Mean Non-White Hitter Productivity).

Table 19: Oaxaca-Cotton Decompositions: White Pitcher / Non-White Hitter

$\Delta \log w^{WP-NWH} = \log w^{WP} - \log w^{NWH}$

		Coef.	*%*
Non-White Hitter Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{NWH}\left(\bar{\mathbf{X}}^{WP}-\bar{\mathbf{X}}^{NWH}\right)$	-0.631	*48.25*
Price Effect:	$\bar{\mathbf{X}}^{WP}\left(\hat{\mathbf{B}}^{WP}-\hat{\mathbf{B}}^{NWH}\right)$	-0.676	*51.75*
Total Differential:	$\hat{\mathbf{B}}^{NWH}\left(\bar{\mathbf{X}}^{WP}-\bar{\mathbf{X}}^{NWH}\right)+\bar{\mathbf{X}}^{WP}\left(\hat{\mathbf{B}}^{WP}-\hat{\mathbf{B}}^{NWH}\right)$	-1.307	*100.00*
White Pitcher Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{WP}\left(\bar{\mathbf{X}}^{WP}-\bar{\mathbf{X}}^{NWH}\right)$	-0.562	*43.03*
Price Effect:	$\bar{\mathbf{X}}^{NWH}\left(\hat{\mathbf{B}}^{WP}-\hat{\mathbf{B}}^{NWH}\right)$	-0.745	*56.97*
Total Differential:	$\hat{\mathbf{B}}^{WH}\left(\bar{\mathbf{X}}^{WP}-\bar{\mathbf{X}}^{NWH}\right)+\bar{\mathbf{X}}^{NWH}\left(\hat{\mathbf{B}}^{WP}-\hat{\mathbf{B}}^{NWH}\right)$	-1.307	*100.00*
Hybrid Wage Structure			
White Pitcher Overpayment:	$\bar{\mathbf{X}}^{WP}\left(\mathbf{B}^{WP}-\bar{\mathbf{B}}\right)$	-0.247	*18.87*
Non-White Hitter Underpayment:	$\bar{\mathbf{X}}^{NWH}\left(\bar{\mathbf{B}}-\mathbf{B}^{NWH}\right)$	-0.473	*36.20*
Endowment Effect:	$\bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{WP}-\bar{\mathbf{X}}^{NWH}\right)$	-0.587	*44.93*
Total Differential:	$\bar{\mathbf{X}}^{WP}\left(\mathbf{B}^{WP}-\bar{\mathbf{B}}\right)+\bar{\mathbf{X}}^{NWH}\left(\bar{\mathbf{B}}-\mathbf{B}^{NWH}\right)+\bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{WP}-\bar{\mathbf{X}}^{NWH}\right)$	-1.307	*100.00*

Table 20: Oaxaca-Cotton Decompositions: White Hitter / Non-White Pitcher

$\Delta \log w^{WH-NWP} = \log w^{WH} - \log w^{NWP}$

		Coef.	*%*
Non-White Pitcher Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{NWP}\left(\bar{\mathbf{X}}^{WH}-\bar{\mathbf{X}}^{NWP}\right)$	0.618	*-97.97*
Price Effect:	$\bar{\mathbf{X}}^{WH}\left(\hat{\mathbf{B}}^{WH}-\hat{\mathbf{B}}^{NWP}\right)$	-1.249	*197.97*
Total Differential:	$\hat{\mathbf{B}}^{NWP}\left(\bar{\mathbf{X}}^{WH}-\bar{\mathbf{X}}^{NWP}\right)+\bar{\mathbf{X}}^{WH}\left(\hat{\mathbf{B}}^{WH}-\hat{\mathbf{B}}^{NWP}\right)$	-0.631	*100.00*
White Hitter Wage Structure			
Endowment Effect:	$\hat{\mathbf{B}}^{WH}\left(\bar{\mathbf{X}}^{WH}-\bar{\mathbf{X}}^{NWP}\right)$	0.708	*-112.17*
Price Effect:	$\bar{\mathbf{X}}^{NWP}\left(\hat{\mathbf{B}}^{WH}-\hat{\mathbf{B}}^{NWP}\right)$	-1.339	*212.17*
Total Differential:	$\hat{\mathbf{B}}^{WP}\left(\bar{\mathbf{X}}^{WH}-\bar{\mathbf{X}}^{NWP}\right)+\bar{\mathbf{X}}^{NWP}\left(\hat{\mathbf{B}}^{WH}-\hat{\mathbf{B}}^{NWP}\right)$	-0.631	*100.00*
Hybrid Wage Structure			
White Hitter Overpayment:	$\bar{\mathbf{X}}^{WH}\left(\mathbf{B}^{WH}-\bar{\mathbf{B}}\right)$	-0.455	*72.18*
Non-White Pitcher Underpayment:	$\bar{\mathbf{X}}^{NWP}\left(\bar{\mathbf{B}}-\mathbf{B}^{NWP}\right)$	-0.850	*134.81*
Endowment Effect:	$\bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{WH}-\bar{\mathbf{X}}^{NWP}\right)$	0.675	*-106.99*
Total Differential:	$\bar{\mathbf{X}}^{WH}\left(\mathbf{B}^{WH}-\bar{\mathbf{B}}\right)+\bar{\mathbf{X}}^{NWP}\left(\bar{\mathbf{B}}-\mathbf{B}^{NWP}\right)+\bar{\mathbf{B}}\left(\bar{\mathbf{X}}^{WH}-\bar{\mathbf{X}}^{NW}\right.$	-0.631	*100.00*