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Racial Differences in Labor Market Values of a Statistical Life

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Abstract

This article constructs measures of job fatality rates for black and white workers using information on job-related fatalities from 1992-1997. The fatality rates for black employees are somewhat greater than those for whites. Each of these groups receives significant compensating wage differentials for fatality risks, controlling for nonfatal risks and expected workers' compensation benefits. The implicit value of a statistical life is lower for black workers than for whites. These results in conjunction with evidence that blacks receive less annual compensation for fatality risks than do whites imply that black and white workers face different market offer curves that are flatter for blacks than for whites.

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Racial Differences in Labor Market Values of a Statistical Life

W. Kip Viscusi

1. Introduction

Researchers have been estimating the labor market value of a statistical life for almost three decades. Notwithstanding the considerable literature that has developed in this area, there is still no consensus on the implicit value of a statistical life estimate based on labor market decisions. As the recent survey by Viscusi and Aldy (2003) indicates, these estimates span a considerable range, with values in some studies being one million dollars or less and values in other studies being ten million dollars or above. Critics of the value of life literature have suggested that the failure to converge to a uniform value of life estimate reflects a fundamental shortcoming of the hedonic wage methodology used to estimate the value of life.

What these criticisms fail to recognize is that the implicit value of a statistical life is not a universal constant. Risk-money preferences will vary across different studies because there is heterogeneity in individual preferences across different samples. In addition, the market offer curves facing workers will differ across these samples, leading to additional sources of difference. Finally, the studies in the literature often do not share an identical methodology in terms of the degree to which the analysis controls for influential factors such as compensation for nonfatal job injury rates and the prospect of workers' compensation benefits, each of which will tend to affect estimates of the tradeoff between wages and fatality risk.

In the literature to date, researchers have focused on three major sources of difference in estimates of the value of life as reflected in risky labor market decisions. First, the value of a statistical life will vary with worker age because workers with a shorter discounted expected future lifetime are risking less of their life than are younger workers.[1] Estimates of the value of life also vary by union status, which one would expect due to the differential bargaining power and informational advantages that trade unions have.[2] Finally, there appear to be substantial differences in the wage-risk tradeoffs by smoking status, as smokers self select themselves into higher risk jobs and receive lower premiums per unit risk than do nonsmokers.[3]

This article examines differences in wage-risk tradeoffs by race, focusing specifically on differences between white and black workers. One would expect there to be racial differences in the value of a statistical life for two reasons. First, preferences with respect to risk may vary by race. To the extent that black workers have lower lifetime levels of wealth than do white workers, they should be more willing to bear risk. There also may be racial differences in tastes that are not correlated with wealth, though the theoretical direction of these differences is unclear. Second, market opportunities may differ by race as well. The substantial literature on market discrimination has documented that there is a persistent difference in the earnings of whites and blacks even after controlling for a broad set of individual characteristics and job characteristics. This article analyzes whether there are differences in opportunities in terms of the market offer curve of wages as a function of fatality risk.

Previous studies have been unable to determine whether there are important racial differences in the values of life. The usual strategy for these studies is to utilize industry level fatality risk data that is then matched to individuals in a sample based on their industry response.[4] Matching average industry risk levels to the worker could create important biases in the estimated fatality risk coefficients. For example, if black workers faced higher risks on the job within the industry than did white workers, then the use of the average industry risk measure would understate the actual risk faced by black workers. If the estimated job risk coefficient were permitted to vary by race, then one would observe a coefficient for black workers that was inflated because it was capturing in part the higher total level of job risk compensation received by these workers and forcing this influence to be reflected in the fatality risk coefficient.

This article uses fatality risk data by race to explore two sets of issues. First, what are the racial differences in the risk levels faced by blacks and whites? Do blacks face higher job risks than whites? Are there such differences even within industry groups? The second class of issues pertains to the estimated values of a statistical life derived from these labor market estimates. Do the estimated tradeoffs between fatality risk and wages differ for black and white workers and, if so, in which direction and to what extent? Analyzing these differences in conjunction with the differences in the overall levels of risk will prove to be instructive in assessing how the labor market for risky jobs differs for blacks and whites. In particular, it will be possible to demonstrate that the lower estimated values of statistical life for black workers cannot be traced simply to differences in preferences. Rather, there must also be differences in job opportunities that account for the observed patterns of risk levels and wage risk premiums.

Section 2 develops the theoretical framework for analyzing the heterogeneity of wage-risk tradeoffs for these different groups. This formulation also outlines how the empirical results can be used to distinguish the respective role of preferences and opportunities in driving the labor market differences. Section 3 presents the death risk data and the sample characteristics that will be used for the analysis. Section 4 presents standard hedonic wage regression results that are distinctive in that separate results are reported for black and white workers based on race-specific information on fatality risks, nonfatal risks of the job, and expected workers' compensation benefits. Section 5 provides conclusions with respect to the implications for labor market performance.

2. Theoretical Framework

The theoretical framework that forms the basis for the empirical analysis follows the standard hedonic wage equilibrium model with one important difference. In particular, I will hypothesize that blacks and whites face quite different market offer curves with respect to risk and settle into quite distinct labor market equilibria.

A considerable economic literature has documented that black employees are paid less than whites controlling for a wide variety of job characteristics and personal characteristics. Thus, we will take as our starting point for the analysis the situation in which wholly apart from the job risk aspect of employment, the wage for blacks will be less than that for whites. Based on this assumption, one obtains wage offer curves as a function of the fatality risk for whites and blacks such as those shown in Figure 1. Each of these offer curves reflects the outer envelope of firms' isoprofit curves and represents the maximum wage rate for each given level of fatality risk that is offered to the worker.[5] The task for the worker is to select the point along the offer curve that yields the highest total expected utility. The curve in Figure 1 U_W indicates the constant expected utility locus that yields the highest possible expected utility for the white worker in this situation. Similarly, the curve U_B indicates the constant expected utility locus that yields the highest expected utility for the black employee facing the black offer curve in Figure 1. As is indicated in the figure, the black employee will pick a higher level of job risk than will the white worker, as P_B is greater than P_W. The subsequent empirical analysis will show that blacks do face a higher overall fatality risk than do whites.

The wage compensation received by each of these groups is shown along the vertical axis in Figure 1. Because the white offer curve in Figure 1 is parallel to the black's offer curve, each of them will receive the same compensation for bearing risk if the risk levels they incur are identical. Because black employees in this diagram are incurring greater risk, they consequently should receive higher levels of compensation. Thus, the total risk premium received by whites in this figure equals $W_W(P_W) - W_W(0)$. Similarly, the risk compensation for the black worker will be $W_B(P_B) - W_B(0)$. This extra risk compensation for the black employee will exceed that for the white employee because P_B exceeds P_W.

Figure 2 illustrates a somewhat different situation in which the offer curve facing black employees in this diagram is flatter than that facing whites. Thus, for any given increase in risk black workers receive a lower marginal risk premium for the risk increase than do whites. As in Figure 1, the black worker shown selects a higher risk level than does the white worker. However, the risk premium received by the black employee, which is given by $W_B(P_B) - W_B(0)$, following the same notation as in Figure 1, is less than the risk premium received by the white worker, which is $W_W(P_W) - W_W(0)$. This need not be the case even if the black offer curve is flatter than that of whites. For example, P_B could be so large that even with the flat offer curve black employees would receive higher compensating differentials for risk than would whites.

It is instructive to summarize the three principal empirical results that will follow and interpret these results within the contexts of these diagrams. First, the overall fatality risk for black workers will be greater than that for whites. This particular observation alone does not provide us any information on whether there are structural differences in the labor market opportunities facing blacks and whites. It could arise, for example, if both whites and blacks face the same offer curve, but the nature of the preferences of black workers was such that they simply picked a higher fatality risk point off the offer curve.

The second empirical observation will be that the implicit value of a statistical life implied by these labor market choices will be lower for black employees than for white employees. This observation also could be consistent with both whites and blacks facing the same offer curve. If black employees chose a higher fatality risk point off the offer curve, the flattening curvature of the offer curve would yield a lower wage-fatality risk tradeoff at higher levels of fatality risk. Thus, evidence of lower values of statistical life for blacks than for whites could be consistent with a completely voluntary choice from identical market opportunities with respect to risk.

The third empirical observation in conjunction with the previous two observations is more telling. The analysis below will show that despite incurring higher overall job risks than whites, black employees receive less total fatality risk compensation than do whites. As a result, these empirical findings indicate that the labor market structure is captured by the situation in Figure 2 in which the risk-related opportunities faced by blacks involve a flatter market offer curve than that faced by whites.

The possibility of the labor markets settling down into separate labor market equilibria for whites and blacks parallels the result for smokers and nonsmokers found in Viscusi and Hersch (2001). That article examined the differences in safety-related productivity of smokers and nonsmokers, which was found to be a contributory factor to these differences. Similarly, one might hypothesize that the differences in the market offer curves for whites and blacks can be attributed to safety-related productivity, discrimination, or other factors, but the role of these factors is not resolved by the analysis here.

3. Death Risk Data and Sample Characteristics

The principal building block for this analysis consists of the death risk data by race. Information with respect to racial differences in fatality rates is not publicly available. As a result, this paper constructed the estimates of the mortality risk measures by coupling fatality risk information from the U.S. Bureau of Labor Statistics Census of Fatal Occupational Injuries (CFOI) with pertinent measures of employment by race and by industry.[6] There have been three different sets of fatality risk data generated by the BLS over the past three decades. The data used in this paper are the most comprehensive. Beginning in 1992 BLS constructed mortality risk data using information from death certificates, medical examiner reports, reports by the Occupational Health and Safety Administration, and workers' compensation injury reports. BLS undertakes an analysis of each reported death using both source documents and a follow-up questionnaire to ensure that the categorization of the death as being job-related is appropriate.

Because of the stochastic nature of death rates and the relatively low probability of death facing any individual worker, this article uses an average of the number of deaths by industry and race over the 1992-1997 period. This six-year average should reduce the extent to which the death risk measure is subject to random fluctuations and make it a more accurate reflection of the underlying risk of the job. From the standpoint of worker decisions, what is critical is the perceived fatality risk of the job, and if the perceptions are accurate this measure should be more strongly correlated with the average death risk for the industry than with the death risk at a particular point in time.

In constructing the death risk variable, the analysis distinguished 72 two-digit SIC code industry groups. The overall process of matching industry-based fatality risk measures to workers should involve less measurement error than using occupation-based measures to the extent that worker reporting of their industry is more accurate than is their reporting of their occupation, as shown in the study by Mellow and Sider (1983).[7] In each case, employment data for the BLS category corresponding to that group was used in constructing the fatality risk measure.[8] Although the subsequent regression analyses will exclude workers who work in agriculture, mining, the armed forces, and public administration, we report the average industry risks for all major industry groups below to illustrate the comparative risk levels in the economy. To construct the fatality risk measure, I used an average of fatality rates from 1992-1997 for the worker's industry. This approach reduces the noise in the fatality risk data series, as there is no substantial trend in fatality rates throughout this period. For example, the total of 6,217 worker fatalities in 1992 is very similar to the total of 6,238 in 1997. Moreover, the total number of workplace fatalities did not differ from the 1997 total by more than 100 fatalities except in a single year, 1994. In that year there were 6,632 fatalities, which was 6 percent higher than the 1997 total.

Table 1 summarizes the overall fatality risk information by a broad industry group and race. The level of aggregation shown in Table 1 is more aggregative than that used in the empirical analysis. The fatality risks are in terms of the total number of fatalities per 100,000 employees. Early studies in the literature using previous BLS measures often found an average fatality risk of roughly one chance in 10,000. There have been improvements in safety over the past three decades so that the average fatality risk across U.S industries is 4 in 100,000, as is shown by the last row in the third column of Table 1.

Overall, black employees face a fatality risk that is somewhat greater than that of whites -- 4.15 fatalities per 100,000 worker as compared to 3.84 per 100,000. The fatality rate is higher for black workers in construction, manufacturing, transportation and utilities, wholesale trade, and retail trade. In contrast, the white employee fatality rate is greater in the remaining industry divisions listed in Table 1. The final two columns of the table indicate the distribution of employees by race, where for the purposes of this calculation only white and black races are included. Asians are omitted from the tally, and Hispanics are classified as either white

Hispanics or black Hispanics. Black employees constitute 11.5 percent of industry employment, and they constitute a disproportionate share of employees in public administration for which the risk levels of black employees are less than the risk levels for whites. Some of the industries in which black employees face particularly high risks relative to whites -- including construction, wholesale trade, and retail trade-- are also industries in which the black employee percentage of industry employment is below the overall black employment percentage so that the weight on these disproportionally high black fatality rates is less.

The empirical analysis will focus on a large sample of employees from the 1997 Current Population Survey (CPS) Merged Outgoing Rotation Group (MORG). After matching the two-digit-level fatality rate variables by race to the employees in the sample one obtains the fatality risk data for the sample population shown in Table 2. The overall fatality rate for the sample is somewhat less than that for the country as a whole, but black workers continue to have a relatively higher fatality rate of 3.83 per 100,000 workers as compared to 3.62 for white employees. By industry group black employees have higher fatality rates than whites with the exception of the finance, insurance, and real estate industry as well as the services industry. The statistics in Table 2 are not identical to the industry level statistics in Table 1 because the industry mix within these different industry divisions may differ, with the notable exception being the construction industry for which there is only a single industry category.

An interesting empirical question with respect to these fatality rates is the extent to which the observed differences between blacks and whites stem from differences in the industries in which they work as opposed to racial differences in fatality rates within the industry. To analyze these differences, consider two different thought experiments. First, what if the black workers in the sample were distributed across industries in Table 2 in the same way as the white employees within that industry? If that were true, the fatality rate for black workers would be even higher than the 3.83 fatalities per 100,000, as it would rise to 4.44 per 100,000 workers. One can reject the hypothesis that this value is equal to the 3.62 fatality rate per 100,000 for white employees at even quite demanding levels of statistical significance.[9] Similarly, if the white employees were distributed across industries in the same proportions as the black employees, their fatality risk would drop to 3.21 fatalities per 100,000 workers, which is significantly different from the black fatality rate of 3.83 fatalities per 100,000 workers.[10] If instead of doing the comparisons on an industry level one were simply to examine the shares of whites in each more broadly defined industry division and apply those shares to the black industry division death rates, one would generate a similar comparison in that the overall death risk for blacks based on the white employee shares by industry division would rise from 4.15 to 4.50.

The final three columns of Table 2 indicate greater differences in the relative lost workday injury and illness rates for black and white employees by industry.[11] As in the case of the fatality rates, these risks were calculated using raw injury and illness numbers and employment statistics for this paper. The risk levels take into account both racial differences in the numerator as well as in the denominator.

Table 3 summarizes the overall sample characteristics of the very large sample of 83,625 white employees and 9,735 black employees from the 1997 CPS MORG data. The sample focuses on non-agricultural workers and also excludes workers in mining, the armed forces, and public administration. The sample is restricted to full-time workers who usually work at least 35 hours per week and employees aged 18-65. The first variable listed in Table 3 is the principal dependent variable in the analysis, which is the workers' hourly wage rate. The hourly wage rate is calculated by dividing the respondent's weekly earnings by the usual weekly hours.[12]

Similarly, the sample also excludes workers whose calculated hourly wage is below the statutory minimum wage of $4.75, which was the minimum wage that prevailed until September 1997. Whites in the sample averaged hourly wages of $2.56 greater than did the black employees. Although the white and black employees are similar in age, the mix of respondents tends to differ on most other characteristics. The white respondents are more likely to be Hispanic, are less likely to be female, had more education,[13] are more likely to be married, and are less likely to belong to a union. Although not indicated in the table, the subsequent regression analysis will also include a series of regional dummy variables, as well as dummies for nine occupational groups and for the construction industry and manufacturing industry. However, for the blue-collar regression results only 4 occupational dummy groups are used.

The three final variables listed in Table 3 are three risk-related measures that will be included in the subsequent empirical analysis. The final variable to be included in the analysis is the expected workers' compensation replacement rate. The particular formula that we use for the role of workers' compensation will take into account the probability that workers' compensation benefits will be received, which I proxy by the lost workday injury and illness rate for the worker. The replacement rate also takes into account the benefit rate that is appropriate for the worker as well as the worker's wage rate. Moreover, because of the favorable tax status of workers' compensation benefits, one should also adjust the formula to take into account the tax exempt nature of workers' compensation benefits. As a result, one obtains the formula for the expected workers' compensation replacement rate given by: [14]

$$\text{Expected WC Replacement Rate} = \text{Injury Risk} \times \frac{\text{Benefit Rate}_i \times \text{Wage}_i\left(\text{Adjusted for min, max}\right)}{(1-t_i)\,\text{Wage}_i}. \quad (1)$$

The benefit rate reflects the fraction of the worker's weekly earnings or spendable weekly earnings that will be covered by workers' compensation, where the benefit rate as well as the choice between weekly earnings and spendable weekly earnings varies across different states. For purposes of these calculations, I use the benefit formulas for temporary total disability, which comprise roughly three-fourths of all workers' compensation claims. The use of other formulas, such as those for permanent partial disability, would lead to almost identical calculations since the principal differences are in terms of the duration of benefits rather than the benefit rate. These calculations are all in terms of the workers' compensation replacement rate for the particular individual in the sample so that they take into account the worker's personal circumstances and are not based on broad statewide average formulas, as has been the norm in almost all previous studies.

As indicated in the formula in equation 1, the wage rate that is included in the calculation takes into account the minimum and maximum benefit amounts permitted under state benefit formulas. Similarly, the average state federal tax rate is included in the denominator of the analysis to reflect the favorable tax treatment of workers' compensation benefits.

4. Regression Estimates

The empirical approach that will be used will be the standard hedonic wage equation models in which there is a regression of the wage rate or the log of the wage rate on a series of explanatory variables including the various personal characteristics, job characteristics, and risk variables. Thus, as with previous studies in the hedonic wage literature, the analysis only generates estimates of the labor market equilibrium generated by the tangencies of the offer curves by firms and the indifference curves of workers. Thus, the empirical estimates do not have an interpretation that reflects either the influences of supply or demand alone, but rather reflects the joint influences of both factors. In terms of the empirical specification, one is led to the following equation for the semi-logarithmic form of the analysis:

$$\ln(\text{Wage}_i) = X_i\beta + \gamma_1 \text{ Death Risk}_i + \gamma_2 \text{ Injury Risk}_i + \gamma_3 \text{ Injury Risk}_i \text{ x Replacement Rate}_i + e_i, \qquad (2)$$

where the natural log of the hourly wage rate is regressed on a vector of variables X_i pertaining to the worker's job, personal characteristics, and region, as well as the death risk variable that is pertinent for worker i, the injury and illness risk that is pertinent for that worker's industry and race, and the expected workers' compensation replacement rate that has been calculated for that worker. In addition to reporting estimates for equation 2, I will also report estimates in which the dependent variable is the wage rate for the worker rather than the log of the wage rate. In terms of the empirical predictions, one would expect there to be positive signs for γ_1 and γ_2 and negative signs for γ_3, which reflects the wage offset workers are willing to accept in return for workers' compensation benefits in the event of job-related injuries.

The empirical analysis examined whether estimates of equation 2 could be obtained for the full sample, but in which there was a possibility of black employees having a different intercept and a different set of risk-related coefficients than white workers. However, appropriate F tests suggested that one can reject the hypothesis that black and white workers can be characterized by the same equation, even with these differences permitted. Similarly, the analysis will also distinguish differences in the equations by gender. The results reported in Hersch (1998) and Viscusi (2003) indicate that there are also important gender-related differences in the earnings equation that cannot be captured simply with a difference in intercept terms.

Table 4 presents representative log wage equations for white and black workers. In each case, Table 4 reports two sets of standard errors. The first standard error reported in parentheses is the White heteroskedasticity-adjusted standard error. To the extent that that error term e_i varies by industry, this adjustment will capture these differences arising from group heteroskedasticity. The more demanding adjustment consists of that undertaken with the second set of standard errors in brackets, which are the robust and clustered standard errors. Because workers in the same industry are assigned the same fatality risk and nonfatal injury risk, and have expected workers' compensation benefits calculated using the same industry and race specific injury risk, there may be correlation of the residuals within workers of a particular industry group.[15]

The robust and clustered standard errors adjust for this influence. Because adjustment for this clustering generally increases the standard errors, it reduces the statistical significance of the estimates of the values of statistical life, which may have been greatly overstated in previous studies that failed to make this adjustment.

Overall, the regression estimates in Table 4 perform in the expected fashion. There is a positive but diminishing age premium with respect to worker age. Hispanics and females receive lower wages, and wages are higher for workers who are better educated, married, or whose employment is covered by a union contract or if they are union members. The primary variables of interest are the three risk-related variables. There is a positive wage premium for fatality risks, a positive premium for nonfatal job risks, and a negative wage offset for expected workers' compensation benefits. Each of these variables has the expected sign, and it is particularly noteworthy that these estimates yield statistically significant estimates of the fatality risk variable even after including the other risk-related variables in the equation.

The only surprising aspect of the results is the substantial wage offset that black workers are willing to accept in return for higher workers' compensation benefits. The wage offset is so great that the partial derivative of the wage rate with respect to the injury rate for black workers is negative rather than positive. Workers should, of course, value insurance at amounts greater than its actuarially fair value. The substantial extent of the wage offset that black workers are willing to accept, particularly when compared to the white employees, suggests that the insurance coverage is particularly valuable to black employees who may be in the kinds of jobs that do not provide other forms of health insurance coverage and disability benefits.

Table 5 summarizes the estimates of the fatality risk coefficients and implicit values of a statistical life for a wide variety of specifications. For both black and white employees, I report five different sets of estimates for both the wage equation and the log wage equation. Panel A in Table 5 reports the results for the semi-logarithmic form of the wage equation. For the various white employee groups, the fatality risk coefficients are statistically significant at the 99 percent confidence level, two-tailed test, in all five instances. Moreover, these coefficients remain significant at that level using the robust and clustered standard errors for both the male and blue-collar male equations, while the significance level drops to the 90 percent level, two-tailed test, for the full sample using the clustered standard errors. White female results are not statistically significant using the clustered standard errors. The estimated values of life for the five different white employee groups range from $9.4 million to $18.8 million. For the blue-collar male results, which have been the focus of most previous studies because of the risky character of these jobs, the estimated implicit values of life are $16.8 million.

The estimates for the counterpart black employee groups appear in the final two columns in Panel A of Table 5. While the full sample of black employees yields results that are statistically significant at the 99 percent confidence level, two-tailed test, using the robust standard errors, the significance levels tend to be less in the other instances using either robust standard errors or the robust and clustered standard errors. For three instances in which statistical significance is not indicated in the table, the coefficients fall just short of statistical significance at conventional levels.[16] The estimates of the implicit value of a statistical life for the five black employee groups range from $5.9 million to $8.9 million. Focusing on the blue-collar male comparison, the value for black workers is $7.2 million as compared to a value of $16.8 million for the white worker counterpart. Similarly, the results for the full sample of blacks each yield implicit values of a statistical life that are less than half of the counterpart values for white employees. In contrast, the estimates for black females are below those for white females, but not to the same extent.

The wage equation results reported in the bottom Panel B of Table 5 yield fairly similar results. The main difference from the previous findings is that the statistical significance of the estimates of the fatality risk coefficients for the various black employee groups is greater than for the log wage equation. Indeed, for the wage equation results, all coefficients are statistically significant at the 90 percent confidence level, two-tailed test, or better for all the robust standard error estimates as well as with the robust and clustered standard errors, with the only exception being white females.

Estimates based on the wage equation indicate consistently lower estimates of the value of statistical life for black employees, with the exception being blue-collar females, for which there is a somewhat higher estimated value. However, for the full sample black workers have a value of life about two-thirds that of whites. For males as a group black employees have a value of life just over half of the counterpart value for white males, and blue-collar black males have a value of life just under two-thirds of the pertinent value for white blue-collar males. Nevertheless, the overall magnitudes of these estimates are quite substantial when compared to previous studies, as the value for black males of $7.7 million and the value for white males of $15.1 million are relatively high compared to other studies of the literature.

Much of this high level of values of life can be traced to the risk measure used. Estimates using industry level CFOI BLS data tend to yield higher estimated values of life than in previous studies using BLS data or data from the National Institute of Occupational Safety and Health. However, if one constructs fatality risks using the BLS CFOI data taking into account both the worker's industry and occupation, doing so substantially reduces the estimated values of life and puts them in terms more comparable to those found in previous studies in the literature. This paper focuses only on an industry level of aggregation rather than attempting to divide worker groups into an extremely fine partitioning based on industry, occupation, and race.

These estimates raise an interesting interpretive issue as to whether these results arise from differences in willingness to bear risk by black workers as opposed to differences in labor market opportunities. Although it is impossible to completely distinguish the respective roles of these influences in the absence of a structural model, it is possible to explore the hypothesis of whether black and white workers are selecting jobs from either the same market offer curve of whether it is an offer curve that differs only in terms of an intercept shift term so that the marginal compensation for risks on the job is identical but the overall wage level may differ.

Table 6 reports differences in annual fatality risk compensation for the white and black employees in the sample. Whites receive $543 in annual fatality risk compensation, as compared to $281 for blacks. The discrepancy for white males as compared to black males is even greater, with a difference of $869 per year as compared to $340 per year. Similarly, blue-collar males receive double the annual compensation for fatality risks if they are white. The gaps for the white and black females are less, but whites still receive more fatality risk compensation per year than do blacks.

These patterns would be plausible if whites faced higher fatality risk levels than did black employees. However, as the results in Table 1 and Table 2 indicated, blacks face a higher overall fatality risk than do white employees. If these workers faced either the same offer curves or offer curves that differed solely through an intercept shift, then one would expect the overall fatality risk compensation for blacks to exceed that for whites. It is impossible to attribute the observed differences in fatality risk compensation and implicit values of statistical life to differences in preferences alone. Even with the lower value of statistical life, the overall wage compensation that black workers receive for bearing fatality risks should be greater than that of whites if they face the same offer curves or offer curves that differed only in terms of an intercept shift. The substantial shortfall that black employees exhibit in terms of the annual compensation for risk despite the higher risk levels they face indicates that black employees do in fact face quite different labor market opportunities.

These findings parallel those found for smokers in Viscusi and Hersch (2001). In that analysis smokers and nonsmokers settled into separate labor market equilibria, where the impetus for these differences stemmed from the differences in their personal riskiness and the risk preferences of smokers as compared to nonsmokers. In the case of the black-white differences, it appears less likely that the explanation for the distinct labor market equilibria can be traced to differences in accident propensities, but this article did not explore such differences. Other possible explanations such as those pertaining to structurally different labor market opportunities by race are more likely explanations.

In terms of the hourly wage gap explained by differences in compensating differentials for risk, the greatest differences between blacks and whites are for males and blue-collar males, for whom differences in the total compensation for fatality risks account for a 28 cent per hour difference in the total hourly wage for these groups. This amount is over 10 percent of the total wage difference between blacks and whites without adjusting for educational differences and other factors that contribute to racial differences in wages.

5. Conclusion

Examination of differences in labor market performance with respect to fatality risks for black and white employees yielded a variety of results that put the situation of black employees in quite positive terms. Black employees do face a higher fatality risk and nonfatal injury risk than do white employees, but the differences are not stark. Moreover, black employees also receive significant compensating differentials for fatality risk, yielding quite substantial implicit values of a statistical life. These results also indicate that black employees receive significant premiums for nonfatal risks on the job so that in the case of both forms of hazards there is evidence of considerable constructive market performance on behalf of black employees.

Other results are less favorable with respect to the well-being of black employees. Black workers have considerably lower implicit values of a statistical life as reflected in their labor market decisions. Moreover, despite facing higher risks than whites, they receive lower annual job risk compensation. Although differences in preferences could be influential, such differences cannot reconcile the various empirical findings. Rather, there must also be fundamental differences in labor market opportunities for blacks and whites as well as in the structure of their offers for risky jobs.

These findings cast considerable doubt on the traditional model of compensating wage differentials for risk. In the usual framework, workers share a common offer curve and sort themselves among different points along it based on their risk preferences. These findings suggest that on important dimensions such as race that different employee groups are in effect settling into quite distinct labor market equilibria. Compensating differentials for risk do in fact exist. These differentials continue to reflect the joint influences of supply and demand. However, because of the differences in market opportunities, it is inappropriate to attribute the observed differences to a greater willingness by black workers to bear risk.

Endnotes

[1] This relationship is actually more complicated due to changes in wealth and earnings over the life cycle. Some theoretical analyses hypothesize that the value of a statistical life will rise and then fall over the life cycle.

[2] See, for example the early analysis of unions in Viscusi (1979). Viscusi and Aldy (2003) review the studies analyzing trade union effects.

[3] See the analysis in Hersch and Viscusi (1990), Hersch and Pickton (1995), and Viscusi and Hersch (2001).

[4] One notable exception is that Viscusi (1979) examines compensation for differences in self assessed hazard levels of a job using the job risk perception variable reported by the respondent.

[5] The underlying economics is well established and will not be reviewed here. See Rosen (1986), Viscusi (1993), Smith (1979), Kniesner and Leeth (1991), and Viscusi and Aldy (2003) for reviews of the theoretical underpinnings.

[6] The fatality risk data are available on CD-Rom from the U.S. Bureau of Labor Statistics.

[7] Black and Kniesner (2003) examine this measurement error issue in detail.

[8] The employment data are drawn from the U.S Bureau of Labor Statistics, Current Population Survey, unpublished table, Table 2, Employed and Experienced Unemployed Persons by Detailed Industry, Sex, Race, and Hispanic Origin, Annual Average 1997 (Based on the CPS).

[9] In particular, the appropriate t statistic for the difference in means for this hypothesis test is 100.7.

[10] For this comparison the pertinent t value for the difference in means is 25.9, which indicates significant differences in all conventional levels of significance. What these results imply is that white in fact have a riskier distribution than do blacks.

[11] The injury and illness risk is based on the number of nonfatal occupational injuries and illnesses involving days away from work with or without restricted work activity and is calculated by race.

[12] The sample omits workers who were top-coded observations. Thus, workers who had wages of $1,923 per week (or $100,000 per year) or weekly hours of 99 were excluded from the analysis.

[13] This sample also excludes respondents who reported an education level below a 9th grade education.

[14] Wages and benefits in Equation 1 are measured on a weekly basis rather than an hourly basis. Taxes were assigned as follows. Workers with a married spouse present are assigned married filing status, workers with married spouses absent are assigned married filing separately, and all others were assigned single filing. Each person received the standard deduction and exemptions, i.e., married filers received three exemptions and married filing separately received two exemptions, as did single filers. Federal tax data were from the Commerce Clearing House, 1998 U.S. Master Tax Guide, 1997, while state taxes were from the U.S. Census Bureau (1999), No. 522 State Governments -- Revenue by State: 1997 and No. 732 Personal Income, by State: 1990 to 1998. Data for D.C. were from the U.S. Census Bureau website, http://www.census.gov/govs/estimate/97sl09dc.html. See Moore and Viscusi (1990) for further discussion of workers' compensation.

[15] Huber (1967) and Rogers (1993) describe the clustering procedure. The previous hedonic wage equation estimates that have taken into account the role of clustering with respect to the standard errors are those by Hersch (1998), Viscusi and Hersch (2001), and Viscusi (2003).

[16] In particular, for black males, the clustered standard errors imply significance levels of 0.106, for blue-collar black females the pertinent value for the robust standard errors is 0.102, and for the robust and clustered standard errors it is 0.105.

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Table 1
Incidence of Fatalities and Employment Percentages by Industry Division and Race
(Fatalities per 100,000 workers)

	Incidence of Fatalities			**Percent of Industry Employment**	
Industry Division	**White**	**Black**	**Total**	**White**	**Black**
Mining	25.63	22.22	25.48	95.69	4.31
Construction	11.85	16.25	12.15	93.05	6.95
Manufacturing	2.96	3.42	3.01	89.06	10.94
Transportation & Utilities	10.38	10.81	10.45	84.50	15.50
Wholesale Trade	4.95	6.30	5.03	93.49	6.51
Retail Trade	2.74	4.33	2.90	90.02	9.98
Finance, Insurance and Real Estate	1.34	1.08	1.31	89.93	10.07
Services	1.71	1.69	1.71	87.30	12.70
Public Administration	5.90	4.57	5.67	82.75	17.25
Grand Total	3.84	4.15	3.88	88.49	11.51

Note: Incidences of fatalities are calculated based on the average number of fatalities from 1992 - 1997 and employment for 1997.

Table 2
Fatality Rates and Injury and Illness Rates for the Sample

	Average Death Risk (Fatalities per 100,000 employees)			Average Lost Workday Injury and Illness Rates (Injuries and Illnesses per 100 employees)		
Industry Division	**White**	**Black**	**Total**	**White**	**Black**	**Total**
Construction	11.85	16.25	12.10	1.64	1.61	1.64
Manufacturing	2.95	3.32	2.99	1.43	1.75	1.46
Transportation & Utilities	10.23	11.73	10.41	1.20	1.45	1.23
Wholesale Trade	4.96	6.57	5.05	1.86	4.27	2.00
Retail Trade	2.83	4.26	2.96	0.94	1.14	0.96
Finance, Insurance and Real Estate	1.28	1.04	1.26	0.29	0.42	0.30
Services	1.60	1.57	1.59	0.56	1.09	0.63
Grand Total	3.62	3.83	3.64	0.97	1.31	1.01

Note: The industry division death risk means by race are significantly different at the 1% level for manufacturing, transportation and utilities, wholesale trade, retail trade, and finance (two-sided tests). The injury and illness risk means by race are significantly different at the 1% level for all divisions except construction. There is no variation in the construction industry division death risk or injury and illness risk because the employment data and the population data report the construction industry at the division level only. Public administration industry employees (for example, legislators) are not in our sample populations; however, public employees in other industry divisions (such as teachers in the services division) are included in the sample. Mining employees were excluded due to inadequate injury data by race.

Table 3
Sample Characteristics

	Mean (standard deviation)	
	White	**Black**
Variable		
Wage (hourly)	14.19	11.63
	(7.19)	(6.04)
Age	38.71	38.28
	(11.01)	(10.72)
Age Squared	1619.65	1580.21
	(884.52)	(856.61)
Hispanic	0.08	0.02
	(0.27)	(0.14)
Female	0.45	0.56
	(0.50)	(0.50)
Years of Education	13.64	13.13
	(2.21)	(1.96)
Married	0.63	0.44
	(0.48)	(0.50)
Union Contract or Member	0.16	0.22
	(0.37)	(0.41)
Death Risk (per 100,000 workers)	3.62	3.83
	(4.03)	(5.32)
Injury and Illness Risk	0.97	1.31
(per 100 workers)	(0.68)	(0.99)
Expected Workers' Compensation	0.68	0.94
Replacement Rate	(0.50)	(0.72)
Number of Observations	83,625	9,735

Table 4
Regression Estimates for ln(Wage) Equations

	Coefficients (Robust Standard Errors) [Robust and Clustered Standard Errors]	
	White	**Black**
Age	0.0419	0.0359
	(0.0008)[a]	(0.0023)[a]
	[0.0017][a]	[0.0024][a]
Age Squared	-0.0431	-0.0355
	(0.0009)[a]	(0.0029)[a]
	[0.0024][a]	[0.0030][a]
Hispanic	-0.1062	-0.0731
	(0.0047)[a]	(0.0260)[a]
	[0.0109][a]	[0.0194][a]
Female	-0.1472	-0.0937
	(0.0029)[a]	(0.0085)[a]
	[0.0150][a]	[0.0102][a]
Education	0.0488	0.0538
	(0.0008)[a]	(0.0025)[a]
	[0.0028][a]	[0.0031][a]
Married	0.0164	0.0185
	(0.0027)[a]	(0.0079)[b]
	[0.0050][a]	[0.0079][b]
Union	0.1390	0.1413
	(0.0036)[a]	(0.0100)[a]
	[0.0175][a]	[0.0187][a]
Death Risk	0.0053	0.0031
	(0.0005)[a]	(0.0009)[a]
	[0.0027][c]	[0.0015][b]
Injury and Illness Rate	0.7535	0.4867
	(0.0077)[a]	(0.0225)[a]
	[0.0664][a]	[0.0605][a]

Expected Workers' Compensation Replacement Rate	-1.0930 (0.0103)[a] [0.0940][a]	-0.6740 (0.0320)[a] [0.0934] [a]
R-squared	0.49	0.41
Observations	83,625	9,735

[a] Indicates statistical significance at the 99 percent confidence level, two-tailed test.
[b] Indicates statistical significance at the 95 percent confidence level, two-tailed test.
[c] Indicates statistical significance at the 90 percent confidence level, two-tailed test.

Note: The equations also include variables for public employment, SMSA, nine occupational groups, eight regions, industry dummy variables for construction and manufacturing, and a constant term.

Table 5
Fatality Risk Estimates and Implicit Values of Statistical Life by Race

Panel A: ln(Wage) Equation Results

Coefficients
(Robust Standard Errors)
[Robust and Clustered Standard Errors]

Sample	**White**		**Black**	
	Death Risk	**Value of Life ($ million)**	**Death Risk**	**Value of Life ($ million)**
Full Sample	0.0053 (0.0005)[a] [0.0027][c]	15.0[e]	0.0031 (0.0009)[a] [0.0015][b]	7.2[e]
Male Sample	0.0061 (0.0005)[a] [0.0020][a]	18.8[d]	0.0024 (0.0012)[c] [0.0014]	5.9[d]
Blue-Collar Male Sample	0.0064 (0.0007)[a] [0.0015][a]	16.8[e]	0.0032 (0.0014)[b] [0.0013][b]	7.2[e]
Female Sample	0.0037 (0.0009)[a] [0.0042]	9.4	0.0031 (0.0014)[b] [0.0019]	6.9
Blue-Collar Female Sample	0.0056 (0.0020)[a] [0.0042]	10.1	0.0051 (0.0031) [0.0031]	8.9

Panel B: Wage Equation Results

Coefficients
(Robust Standard Errors)
[Robust and Clustered Standard Errors]

Sample	**White**		**Black**	
	Death Risk	**Value of Life ($ million)**	**Death Risk**	**Value of life ($ million)**
Full Sample	0.0668 (0.0065)[a] [0.0352][c]	13.4	0.0465 (0.0128[a] [0.0204][b]	9.3
Male Sample	0.0754 (0.0080)[a] [0.0322][b]	15.1[f]	0.0386 (0.0172)[b] [0.0212][c]	7.7[f]
Blue-Collar Male Sample	0.0751 (0.0093)[a] [0.0236][a]	15.0	0.0479 (0.0187)[a] [0.0171][a]	9.6
Female Sample	0.0567 (0.0114)[a] [0.0466]	11.3	0.0437 (0.0176)[b] [0.0240][c]	8.7
Blue-Collar Female Sample	0.0699 (0.0225)[a] [0.0406][c]	14.0	0.0718 (0.0390)[c] [0.0389][c]	14.4

Notes:
[a] Indicates statistical significance at the 99 percent confidence level, two-tailed test.
[b] Indicates statistical significance at the 95 percent confidence level, two-tailed test.
[c] Indicates statistical significance at the 90 percent confidence level, two-tailed test.

The following tests are based on differences in the fatality risk coefficients.

[d] Indicates that whites and blacks are significantly different at the 99 percent confidence level, two sided test.
[e] Indicates that whites and blacks are significantly different at the 95 percent confidence level, two sided test.
[f] Indicates that whites and blacks are significantly different at the 90 percent confidence level, two sided test.

Table 6
Annual Fatality Risk Compensation by Race[a]

	Annual Fatality Risk Compensation ($)	
Sample	White	Black
Full	542.70	281.36
Male	869.16	340.06
Blue-Collar Male	1,090.11	535.46
Female	198.02	155.50
Blue-Collar Female	267.56	246.78

[a] Notes: All mean values are calculated based on the average of the annual rates of compensation calculated on individual basis for each person in the sample. The pertinent t statistics for the differences in mean values for the five groups are: 34.93, 35.30, 25.84, 10.63, and 1.96. All differences are statistically significant at the 99 percent level except for blue-collar females, which is statistically significant at the 95 percent level.

Figure 1
Compensating Differentials by Race with Parallel Offer Curves

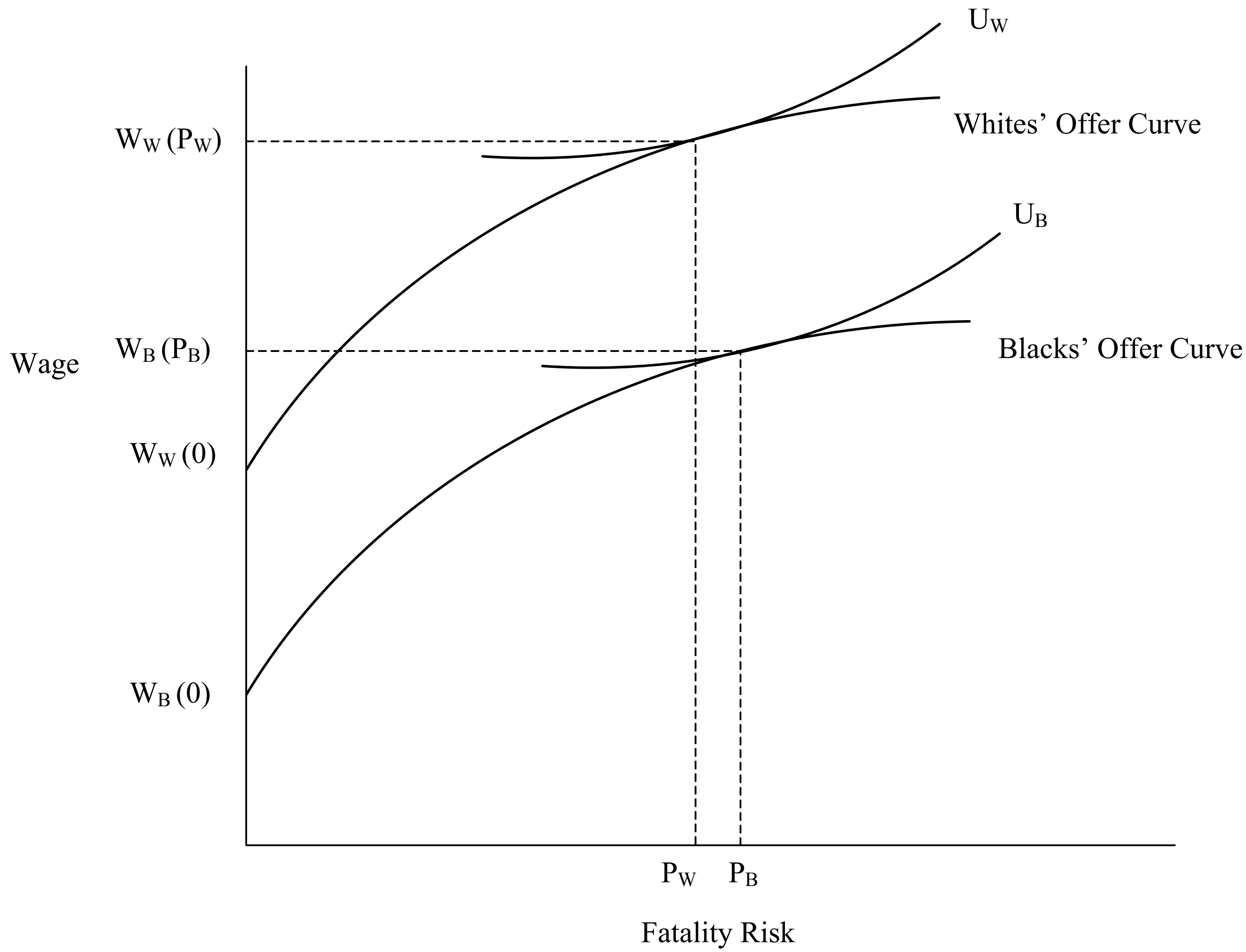

Figure 2
Compensating Differentials by Race If Blacks Have Flatter Offer Curves