

Black-White Wage Inequality, Employment Rates, and Incarceration¹

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The observed gap in average wages between black men and white men inadequately reflects the relative economic standing of blacks, who suffer from a high rate of joblessness. The authors estimate the black-white gap in hourly wages from 1980 to 1999 adjusting for the sample selection effect of labor inactivity. Among working-age men in 1999, accounting for labor inactivity—including prison and jail incarceration—leads to an increase of 7%–20% in the black-white wage gap. Adjusting for sample selectivity among men ages 22–30 in 1999 increases the wage gap by as much as 58%. Increasing selection bias, which can be attributed to incarceration and conventional joblessness, explains about two-thirds of the rise in black relative wages among young men between 1985 and 1998. Apparent improvement in the economic position of young black men is thus largely an artifact of rising joblessness fueled by the growth in incarceration during the 1990s.

Inequality between black men and white men is often measured by wage differences in the civilian labor force (e.g., Cancio, Evans, and Maume 1996; Sakamoto, Wu, and Tzeng 2000; McCall 2001; Grodsky and Pager 2001). However, comparisons of wage earners may inaccurately describe

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the relative economic status of black men. There are strong race differences in labor force attachment, and the labor force participation of black men has been relatively low since the 1950s (Wilson 1987; Fairlie and Sundstrom 1999). Because the jobless rate is high among men with low potential earnings, relatively few low-skill black men are included in assessments of wage inequality. The lower tail of the black wage distribution is truncated by a high rate of joblessness, and the observed wage gap between black and white men understates racial inequality. In short, the black-white wage gap is partly the artifact of a sample selection effect.

Interest in the sample selection effects of unemployment on wage inequality arose in studies of antidiscrimination policy in the 1960s and 1970s. Wage convergence between black men and white men in this period was widely attributed to improvements in school quality, expanded public-sector employment, and equal employment opportunity (Burstein 1979; Hout 1984; Heckman 1989; Card and Krueger 1992; Darity and Myers 1998, pp. 44–45). In contrast to this research, some studies observed that growth in the relative wages of black men accompanied declining employment. Part of the decline in black-white wage inequality thus appeared as a result of increased joblessness among low-skill black men (Butler and Heckman 1977; Brown 1984; Jaynes 1992). Consequently, the wage-equalizing effects of antidiscrimination policy were overestimated.

This article revisits the sample selection effect of joblessness on estimates of wage inequality. Although economists have conducted most research on sample selection and wage inequality, the topic is also of clear importance for sociologists. Three main issues are at stake. First, sociological research on wages and research on employment proceed largely on separate tracks, producing an inconsistent assessment of black economic progress. Analysis of wages often emphasizes the economic gains of African-Americans and the progressive effects of public-sector employment and measures for equal employment opportunity (Burstein 1979; Burstein and Edwards 1994; Grodsky and Pager 2001; cf. McCall 2001). On the other hand, studies of employment find persistent inequalities rooted in historic and contemporary discrimination (Wilson 1987; Massey and Denton 1994). Analysis of sample selection helps reconcile these findings by explaining how the appearance of relative wage gains may result from declining employment opportunities among low-skill men.

Second, recent debate disputed the relative effects of skill and discrimination on racial inequality in wages (Cancio et al. 1996; Farkas and Vicknair 1996; Johnson and Neal 1998). This debate bracketed the issue of sample selectivity even though low-skill black men are likely to be underobserved in analyses of wages. If sample selection effects are large, the effect of skill on wages may be significantly underestimated.

Finally, the selection analysis shows that statistics like the black-white

wage gap cannot be taken at face value. Wage differentials are embedded in broader patterns of racially differentiated labor force attachment (Mare and Winship 1984). Although earlier research focused on the 1960s and 1970s, the effect of labor force participation on the economic standing of black men has acquired renewed importance. The growth of the U.S. penal system through the 1980s and 1990s removed an ever-growing fraction of young, low-skill black men from the noninstitutional population. By 1999, over 40% of young black male high school dropouts were in prison or jail compared to 10.3% of young white male dropouts (Western and Pettit 2002). High incarceration rates have the effect of concealing poor young men in conventional labor force statistics. Earlier work (Western and Beckett 1999) argued that the U.S. labor market gains through the 1990s economic expansion were overstated by the usual measures of employment. That earlier article examined the effects of incarceration on employment statistics by imputing an employment status to prison and jail inmates. In this discussion we also consider the economic status of the penal population to see whether joblessness through incarceration created the appearance of relative wage gains by black men during the 1990s.

Our analysis estimates the black-white wage gap, adjusting for relatively high rates of joblessness and incarceration among black men. Although we build on earlier work that studies the effects of labor force attachment on black-white inequality (Mare and Winship 1984; Blau and Beller 1992; Western and Beckett 1999), our analysis goes further in several ways. First we examine data through the 1990s, a period of wage convergence among young black and white workers. Second, we impute wages to the penal population using correctional surveys that report preincarceration wages for prison and jail inmates. Finally, we develop a predictive Bayesian analysis of the wage adjustment that yields standard errors for the selection effect of labor inactivity on wage inequality. By including economically marginal men that are usually ignored in labor force research, our analysis aims at a comprehensive assessment of racial inequality between black men and white men.

RECENT TRENDS IN WAGES AND EMPLOYMENT

Table 1 reports the mean of log hourly wages for non-Hispanic, nonfarm black men and white men between 1980 and 1999 using the Merged Outgoing Rotation Group files of the Current Population Survey (CPS). Mean wages are reported for all employed men, including those in part-time work. The data show two patterns. First, the wage advantage of working-age whites changed little from 1985 to 1999. The hourly wage

TABLE 1
AVERAGE LOG HOURLY WAGES, WHITE MEN AND
BLACK MEN, 1980-99

	Whites (1)	Blacks (2)	Difference (1) - (2)
Men ages 22-64:			
1980-84	2.188	1.902	.286
1985-89	2.361	2.053	.308
1990-94	2.504	2.190	.314
1995-99	2.639	2.334	.305
Men ages 22-30:			
1980-84	1.968	1.777	.192
1985-89	2.097	1.869	.228
1990-94	2.224	2.006	.218
1995-99	2.327	2.140	.187

of working-age white men exceeded that of blacks by about 30%. Second, inequality increased among young men until the mid-1980s and then declined through the 1990s. Like other research, these tabulations show that the relative earnings of young black men were falling through the early 1980s (Bound and Freeman 1992, table 1; Cancio et al. 1996). Observed wage inequality peaked in 1985 and fell by about 20% over the next 15 years.

Relative wage trends contrast with shifts in joblessness. The jobless can be divided into two categories—the noninstitutional jobless and those institutionalized. Among young men, most of the institutional population is incarcerated. The noninstitutional jobless, whom we call nonworkers, consist of the unemployed and those not in the labor force. Nonworkers are counted by the CPS. Prison and jail inmates are counted using aggregate administrative records and correctional survey data (see the appendix). This approach follows the census employment concept in which the institutional population are counted among those without work.

The incarcerated significantly increased their share of total joblessness between 1980 and 1999 (see table 2). Among all white men of working age, about 2% of those without jobs were in prison or jail in 1980 compared to 6% by 1999. The share of inmates among the jobless is almost twice as high for white men ages 22-30. Incarceration's share of joblessness is much higher for blacks. More than 20% of nonworking black men of working age were in prison or jail in 1999. Among black men ages 22-30, incarceration accounted for 30.5% of all joblessness in this same year. The final column of table 2 shows changes in racial inequality in joblessness. In contrast to patterns of wage inequality, racial inequality in employment increased for all working-age men and young men between

TABLE 2
% JOBLESS MALES IN THE POPULATION AND AMONG THE INCARCERATED, 1980–99

	JOBLESS WHITES		JOBLESS BLACKS		BLACK- WHITE RATIO (3) / (1)
	% in	% Incarcerated	% in	% Incarcerated	
	Population		Population		
	(1)	(2)	(3)	(4)	
Men ages 22–64:					
1980–84	15.5	3.2	30.5	10.8	1.97
1985–89	14.4	3.5	28.8	14.9	2.00
1990–94	15.3	4.6	31.2	18.6	2.04
1995–99	14.6	6.2	30.8	23.4	2.11
Men ages 22–30:					
1980–84	15.4	4.5	34.9	16.0	2.27
1985–89	12.5	8.0	30.4	23.0	2.43
1990–94	14.2	8.5	34.2	26.6	2.41
1995–99	13.2	10.6	33.5	32.8	2.54

1980 and 1999. Among young men, the black-white ratio in joblessness increased by about 20%, driven largely by the rise in incarceration rates.

JOBLESSNESS AND SAMPLE SELECTION BIAS

Research on wage inequality often ignores the high rate of joblessness among blacks. Instead, inequality is chiefly explained by employer discrimination and the distribution of skills among workers. Declining racial inequality in wages through the 1960s and 1970s has been linked to protections offered by the 1964 Civil Rights Act, affirmative action policies in large firms, and increased government employment among blacks that helped to circumvent private-sector discrimination (Heckman 1989; Hout 1984; Donohue and Heckman 1991; Chay 1998). More recently, labor market researchers traced the black-white wage gap to low levels of skill among black workers (Farkas and Vicknair 1996; Johnson and Neal 1998; cf. Cancio et al. 1996). Discrimination and skill surely affect racial inequality in wages, but they cannot account for declining wage inequality during periods of relatively low or shrinking employment among black workers.

The divergence between wage and employment trends for African-American men can be reconciled by considering the sample selection effects of joblessness on average wages. The effects of sample selection are illustrated in figure 1, which shows hypothetical distributions of log wages for blacks and whites. We can interpret these distributions as the wage offers that would be received by blacks and whites if they all were work-

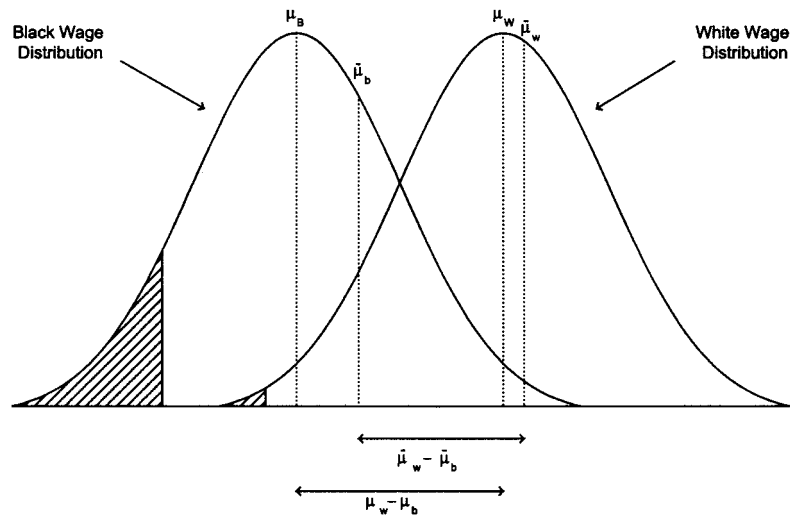


FIG. 1.—Hypothetical black and white wage distributions (shaded areas indicate wages unobserved because of joblessness; means estimated from the observed wage distribution are given by $\bar{\mu}$; means of the complete wage distributions are given by μ).

ing. Racial inequality is measured by the white-black difference in means, $\mu_w - \mu_b$. The lower tail of each distribution is shaded indicating that wage offers for those with low-potential earnings are unobserved because of joblessness. The shaded area is larger for blacks than whites, because joblessness among blacks is relatively high. Mean wages, $\bar{\mu}$, calculated just from the the observed wages, will exceed the mean of the wage distribution μ . This implies

$$\mu_w - \mu_b > \bar{\mu}_w - \bar{\mu}_b.$$

Because the black wage distribution is truncated more than the white, naive estimates of inequality based just on observed wages, $\bar{\mu}_w - \bar{\mu}_b$, will underestimate inequality in the economic standing of black men.

Sample selection analysis tries to impute wages to the lower tails of these distributions and adjust estimates of the wage gaps. Imputing wages can be understood as an effort to monetize the economic status of marginal segments of the population that are typically ignored in studies of economic inequality. We monetize economic marginality, not by putting a dollar value on joblessness, but by predicting the wage offers that would be received by the jobless if they were working.

Why are jobless rates for blacks persistently higher than those for whites? The employment gap between black men and white men is often given a structural interpretation. Residential segregation, the decline of

urban manufacturing industry, or some combination of the two accounts for high rates of joblessness among black men with low levels of education in urban areas (Wilson 1987; Lichter 1988; Massey and Denton 1994; cf. Wilson, Tienda, and Wu 1995). Although structural explanations commonly account for the race gap in male employment, labor inactivity is also linked to institutions outside the labor market. Butler and Heckman (1977) offered an early analysis of this type, noting that income-transfer benefits increased at the same time as the passage of the 1964 Civil Rights Act. They conjecture that the increase in benefits drew low-wage men out of the labor force. Increased average earnings were the result of declining employment among low-pay workers rather than an upward shift in the income distribution. Mare and Winship (1984) observe that institutional forces can also reduce labor force participation among more able workers. Their analysis of school enrollment and military service between 1964 and 1981 showed that around half the increase in the race gap in employment through the 1960s and 1970s was because of these institutional attachments. Conventional employment figures understated the economic position of black men at a time when black school attendance and military enlistments were rising.

Growth in incarceration rates through the 1980s and 1990s motivates a reexamination of an institutional basis for the selection effects of labor inactivity. Rising incarceration rates result mostly from changes in criminal justice policy. From the 1970s to the 1990s, a punitive shift in criminal processing—including the intensified criminalization of drug-related activities and tough-on-crime sentencing—led to an increased likelihood of a prison sentence and longer prison sentences for convicted offenders (Blumstein and Beck 1999). Researchers also claim that the growth in incarceration has likely been concentrated among disadvantaged minority men (Tonry 1995; Wacquant 2000). While public policy may have significantly reduced discrimination in hiring, labor market inequality may still be affected by racial disparities in the criminal justice system.

DATA AND METHOD

Earlier studies of racial inequality combined observed earnings from workers with imputed earnings from nonworkers. Earnings for nonworkers were either set by assumption or imputed from marginal workers for whom earnings were observed (Brown 1984; Smith and Welch 1989; Welch 1990). Similar to the current approach, Blau and Beller (1992) regressed earnings on human capital and other covariates and predicted hypothetical wages using the observed covariates of nonworkers. Chandra (2003) elaborated this approach by imputing earnings for age-education

subgroups, where the imputation methods varied for the unemployed, those not in the labor force, and the incarcerated.

Earlier research focused on trends from the 1960s through the 1980s. To study wage inequality through the 1990s, we analyze data from the CPS and correctional surveys of inmates. Our estimates of inequality are based on log hourly wages, although we found similar results for weekly earnings. The analysis is restricted to non-Hispanic, nonfarm, civilian men. We report results for white men and black men in the age groups 22–64 and 22–30. Excluding those under age 22 minimizes the number of students in the sample. Employment-population ratios for the noninstitutional population are calculated using the CPS survey weights. Labor inactivity caused by incarceration is estimated using aggregate administrative data and correctional surveys.

If log wages of white and black men are written y_w and y_b , then the difference in mean wages is given by $\bar{d} = \bar{y}_w - \bar{y}_b$. Since hypothetical offer wages of the jobless are not observed and the jobless are likely to come from the lower tail of the wage distribution, \bar{d} is a biased estimate of the wage differential. To adjust the wage differential for selective attrition from employment, we calculate

$$\hat{d} = \hat{y}_w - \hat{y}_b,$$

where the adjusted means, \hat{y}_i , are based on imputed mean wages for nonworkers. Omitting the race subscripts, the adjusted mean wage is the weighted average,

$$\hat{y} = (1 - p_N - p_I)\bar{y}_W + p_N\bar{y}_N + p_I\bar{y}_I,$$

where the subscript W denotes the mean calculated for workers from observed wages, \bar{y}_N is the mean wage for nonworkers (the unemployed and those not in the labor force), \bar{y}_I is the mean wage of the incarcerated, and the weights p_N and p_I are proportions of the population not working or incarcerated.

Like previous research, we predict the wages of the jobless given age and education (Blau and Beller 1992; Chandra 2003). These covariates capture the main human capital differences in wages. (We also experimented with region and marital status but those variables added little to the results reported below.) Age is measured discretely in five categories: (1) 22–25, (2) 26–30, (3) 31–40, (4) 41–50, and (5) 51–64. Education is divided into three categories: (1) less than a high school diploma or equivalent, (2) high school diploma or GED, and (3) at least some college. The covariates are used not to estimate the effects of age and education on wages, but to help sharpen predictions for the wages of the jobless. The

predicted mean wage for workers and prison and jail inmates is obtained from the regression,

$$\bar{y}_j = \bar{X}_j' b_j, \quad (1)$$

where $j = W, N$, or I ; where age and education data are collected in the matrices, X_j ; and \bar{X}_j is a vector of covariate means. Following Chandra (2003), we take a nonparametric approach to the regression in which age and education are interacted, yielding predicted wages for each age-education subgroup. If X_j consists of $5 \times 3 = 15$ columns of dummy variables indicating each cell in the age-by-education table, \bar{X}_j is simply a vector of cell proportions for workers, nonworkers, and prison and jail inmates. With this model, the regression coefficients, b_j , give the mean log wages for each age-education cell.

The adjusted means, \bar{y}_j in equation (1), depend on unknown quantities. The population proportions of those not working and incarcerated, p_N and p_I , can be calculated along with the age-education cell proportions, \bar{X}_j . However, the regression coefficients, b_j , can only be estimated for workers since the counterfactual wages of nonworkers and inmates are not observed. We adopt two strategies to impute wages to the age-education tables of nonworkers and the incarcerated.

First, nonworkers and inmates are matched to the mean wages of workers. The matching estimator can be written as regression equations: $\bar{y}_N = \bar{X}_N' b_W$ for nonworkers and $\bar{y}_I = \bar{X}_I' b_W$ for prison and jail inmates. Mean wages are predicted accurately if, given age and education, the mean offer wages of nonworkers and the incarcerated are identical to the mean wage of workers. We call this approach the AE (age-education) adjustment. With the AE adjustment, wage differences between workers and the jobless are the result of differences in the age-education distribution. The mean counterfactual wage of nonworkers is lower than the observed mean wage of workers if nonworkers are clustered in the low-wage cells of the age-education table. Table 3 reports the age and education distributions for workers, nonworkers, and prison and jail inmates. Nonworkers tend to be older but less educated than workers. Nonworkers are about three times more likely than workers to have dropped out of high school and only three-quarters as likely to have attended college. The age and education disadvantage of prison and jail inmates is even larger. Inmates are relatively young and six to seven times more likely than workers to have dropped out of high school.

The key assumption of the AE adjustment is that the wage offers received by the jobless, given age and education, are equal to those of the employed. Of course, the assumption is unrealistic because those at risk of prison and unemployment earn less than others in the labor force

TABLE 3
WORKERS, NONWORKERS, AND INMATES, 1999

	Workers	Non-workers	Inmates
White men:			
Age:			
22–25	8.2	9.3	13.7
26–30	12.0	7.3	19.1
31–40	29.1	15.4	39.4
41–50	29.1	19.8	19.8
51–64	21.6	48.1	8.0
Schooling:			
< high school	7.0	19.4	50.8
High school or GED	31.7	35.4	30.7
Some college	61.3	45.2	18.6
Black men:			
Age:			
22–25	9.4	12.7	17.4
26–30	15.2	11.4	22.5
31–40	32.9	20.5	40.6
41–50	27.6	23.9	15.9
51–64	14.9	31.5	3.6
Schooling:			
< high school	10.6	31.5	59.4
High school or GED	39.7	39.3	27.8
Some college	49.3	29.1	12.8

(e.g., Bound and Freeman 1992; D’Amico and Maxwell 1994). The wage deficit unexplained by age and education is likely to be especially large for prison and jail inmates. Typically, former inmates obtain relatively low returns to education, and crime-involved men have low levels of cognitive ability given their schooling (Waldfogel 1994; Western 2002). By neglecting their low productivity, we may overestimate the hypothetical wages of the jobless. As a result, the analysis will underestimate the impact of labor inactivity on average wages.

Earlier sample selection studies of wage inequality accounted for the influence of unobserved variables by assumption. For example, Blau and Beller (1992) assume that the jobless earned 40% less than workers with the same observed characteristics. Chandra (2003) assumes that the long-term unemployed earn less than the median wage of workers of the same age and education. Predictions that acknowledge the low productivity of the jobless may be more realistic than predictions based on the AE adjustment. Still, the estimated effect of sample selection in earlier research remains sensitive to untested assumptions about the effects of unobserved variables on hypothetical wage offers.

We address this limitation with our second strategy, which introduces data on the earnings potential of prison and jail inmates. Correctional surveys of inmates, fielded periodically by the Bureau of Justice Statistics, ask respondents about their wages immediately before incarceration. About a third of the inmates were not working when admitted to prison or jail. Preincarceration wages are reported by 30%–50% of respondents in each of the nine correctional surveys we analyze. The data provide estimates of inmate wages by age and education, b_i . The mean offer wage for inmates is predicted by $\bar{y}_i = \bar{X}_i' b_i$, which we call the AEI (age-education-incarceration) adjustment.

Do the wage data from inmate surveys accurately predict the wage offers that criminal offenders would receive if they were working? The correctional data may understate wage offers if a loss in income causes or is otherwise related to the crime that leads to imprisonment. On the other hand, hypothetical wage offers are likely to be relatively low among the many inmates who are jobless at the time of incarceration. Our imputation strategy matches these jobless offenders to the wages of those who were working at the time of incarceration, likely leading to an overestimate of mean wages in the correctional population. Because the predicted wages may be too high or too low, we are uncertain about how well the inmate wage data can predict the wages these men would be offered if they were not in jail. This uncertainty is incorporated in the calculation of standard errors and confidence intervals.

Mean wages from the correctional surveys for 1999 are compared to mean wages for workers in table 4. Wages for inmates are reported at time of admission. Although wages at admission are not adjusted to current age, jail inmates (a third of the penal population) were incarcerated less than a year earlier, and about two-thirds of prisoners reporting wages were incarcerated for two years or less, so the time between age at admission and current age is short.² Moreover, wages grew slowly for criminal offenders and those with little schooling in the 1980s and 1990s (Western 2002), reducing the chance that the inmate wage data are out of date. At all ages, the hourly wage of prison and jail inmates is only about half the wages of men who have not been to prison. Returns to education also appear to be lower for incarcerated men. The wages of inmates before incarceration are lower than those for employed men at every level of education. The wage gap between inmates and the employed grows with increasing education.

The AE and AEI adjustments set upper and lower bounds on the effects

² The wage data are adjusted for inflation from prison and jail admission to current age. We also experimented with wage data just from inmates admitted in the previous year and obtained results that were essentially the same as those reported below.

TABLE 4
 MEAN HOURLY WAGES FOR MALE WORKERS AND MEAN PREINCARCERATION WAGES
 FOR MALE PRISON AND JAIL INMATES, 1999

	White Men		Black Men	
	Workers	Inmates	Workers	Inmates
Age:				
22–25	11.04	7.65	9.68	7.37
26–30	14.79	12.53	11.88	5.92
31–40	18.62	8.92	13.35	8.70
41–50	21.12	11.77	14.64	6.04
51–64	21.45	9.83	15.19	10.31
Schooling:				
< high school	11.71	9.03	9.57	6.74
High school or GED ...	14.57	11.01	11.67	6.82
Some college	21.92	12.06	15.62	10.40

NOTE.—Wages are given in 1999 dollars.

of sample selection on racial inequality in wages. Relying just on the wages of workers (the AE adjustment) likely overstates the offer wages of the jobless, minimizing the impact of labor inactivity on wage inequality. Predicting hypothetical wage offers of inmates with preincarceration wages (the AEI adjustment) may accentuate the sample selection effect on inequality. Still, any overestimate of offer wages in the correctional survey data is offset by the use of workers' wages to predict the offer wages of nonworkers.

Uncertainty about the size of the wage adjustments motivates a Bayesian analysis that specifies a subjective probability interval for adjusted wages and the sample selection effect. Building on Rubin's (1977; Little and Rubin 1987) analysis of missing data, we calculate a Bayesian distribution for the predictive mean, $\bar{y}_j = \bar{X}_j' b_j$. Here, \bar{X}_j is scaled to reflect the proportion of workers, nonworkers, and inmates in the population, so the sum of the elements of \bar{X}_N , say, equals the proportion of workers in the population, p_N , and the sum of all the elements of \bar{X}_W , \bar{X}_N , and \bar{X}_I equals 1. Parameterized this way, the predictive distribution of mean wages conditional on the observed wage data for workers is the sum of the predictive distributions for workers, nonworkers, and inmates,

$$p(\bar{y}|y) = p(\bar{y}_W|y) + p(\bar{y}_N|y) + p(\bar{y}_I|y).$$

With diffuse prior information on the regression coefficients, the predictive distributions are given by the integral,

$$p(\bar{y}_j|y) = \int p(\bar{y}_j|b_j)p(b_j|y)db_j,$$

where $j = W, N$, or I , where $p(\bar{y}|b_j)$ is the predictive distribution of the mean given observed wages, and $p(b_j|y)$ is the posterior distribution of the coefficients given observed wages. The mean and variance of this distribution can be found by simulating from the posterior distribution for the coefficients, $p(b_j|y)$. For workers, the posterior is normally distributed with a mean located at the least-squares estimate of b_w and a variance equal to the least-squares covariance matrix, \hat{V}_w . Randomly generated coefficient vectors, b_w^* , are used to simulate from the predictive distribution for \bar{y}_w by calculating $\bar{y}_w^* = \bar{X}_w' b_w^*$. In this case, the variance of \bar{y}_w^* is known to be s^2/n , where s^2 is the least-squares estimate of the error variance and n is the sample size for the regression. Although the mean and variance of the predictive distribution are simply calculated for this case, we use simulation because it provides an easy way to incorporate prior information and to estimate selection effects based on ratios of predictive distributions.

There are no sample data on wages for nonworkers and inmates, but prior information is given by wage data in the CPS and correctional surveys. Uncertainty about the predictive mean is a function of prior uncertainty about the coefficient vectors b_n and b_i . With the AE adjustment, prior uncertainty about the counterfactual wages of nonworkers and inmates depends partly on sampling uncertainty in the CPS wage estimates and subjective uncertainty about the utility of the CPS for predicting counterfactual wages of the jobless. Prior means for the coefficients, b_N and b_I , are given by the mean wages for workers, b_w , yielding predictive distributions centered at $\bar{y}_N = \bar{X}_N' b_w$ and $\bar{y}_I = \bar{X}_I' b_w$. We set prior variances for the coefficients to multiples of the least-squares variances, $\psi_1^2 \hat{V}_w$ (for nonworkers) and $\psi_2^2 \hat{V}_w$ (for inmates). The prior parameters ψ_1 and ψ_2 describe our confidence that the offer wages of the nonworkers and inmates match the CPS wages for workers. If we think that the AE assumption is true and the conditional wages of workers accurately describe the counterfactual wages of the jobless, then $\psi_1 = \psi_2 = 1.0$. Throughout this analysis we set $\psi_1 = \psi_2 = 2.0$ reflecting our skepticism that the survey data on which our priors are based accurately predict the unobserved wages. With these priors, uncertainty about the true location of the coefficient vectors b_N and b_I is set to twice the conventional sampling uncertainty that we would usually calculate from the CPS and the correctional data. For the AEI adjustment that uses preincarceration wages to predict inmates' wages, the predictive mean is $\bar{y}_I = \bar{X}_I' b_I$. The prior variance is given by $\psi_2^2 \hat{V}_I$, a multiple of the least-squares covariance matrix calculated from the correctional survey data.

We simulate the predictive distribution of mean wages for all (white or black) men by taking random draws from a normal distribution centered at the least-squares estimates of b_w and b_I with the least-squares

covariance matrices multiplied by ψ_1^2 and ψ_2^2 . We randomly draw from the predictive mean distribution by taking 5,000 random draws of the coefficient distributions for workers, nonworkers, and inmates and calculating the weighted sum, $\hat{y}^* = (1 - p_N - p_I)\bar{y}_W^* + p_N\bar{y}_N^* + p_I\bar{y}_I^*$. We use these distributions of adjusted mean wages to simulate distributions of the selection-adjusted wage differential, $\hat{d}^* = \hat{y}_w^* - \hat{y}_b^*$. The simulated values, \hat{y}^* and \hat{d}^* , are used to construct standard errors and confidence intervals reported below.

The Bayesian analysis produces subjective predictive distributions. As Rubin (1977, p. 538) observes in his Bayesian analysis of missing data, subjective analysis is unavoidable because "one cannot make totally objective probability statements about how respondents would respond without some response data from them." Similarly, our analysis does not observe the hypothetical wage offers received by nonworkers and inmates. Consequently, standard errors and confidence intervals describe our subjective uncertainty that the selection-adjusted mean wage lies within a particular interval. Uncertainty is the result of the usual sampling variability in observed wages and subjective judgments about how well the priors predict the offer wages of nonworkers and inmates. The predictive distribution also depends on prior parameters, ψ_1 and ψ_2 , that are subjectively chosen. Because others might prefer different values for ψ_1 and ψ_2 we explore the sensitivity of our results to the priors below.

Several biases affect our method for estimating the sample selection effect of joblessness on relative earnings. Two biases lead to an overestimate of the wage gap. First, the adjusted wage gap is overestimated because the analysis ignores the selection effect of the military. Blacks have higher rates of military service than whites, and Mare and Winship (1984) show that the military siphons off many of the most able black workers. Although military service is bracketed from this analysis, bias in the adjusted wage gap is small and likely declines over time. Chandra (2003) found that by 1990, the selection effect of incarceration was about four times larger than the selection effect of military service. Unlike the penal population, which has grown rapidly, the number of active-duty troops fell by about 25% between 1989 and 1995. The tight labor market of the 1990s may also reduce the selection effect of military service as skilled workers reject enlistment for work on the open labor market (Brown 1985). Second, bias will also result from the likely endogeneity of some of the independent variables in the wage regression to incarceration. For example, low education among inmates may result from interruptions to schooling by prison time. If the incarceration rate was zero, levels of schooling may be higher and our selection-adjusted wage for inmates would be too low. This endogeneity bias leads us to overestimate the selection effect of incarceration.

These biases are balanced by labor supply effects. When selective labor force attrition is lower and the jobless are employed, earnings are likely to fall because of the increased supply of low-skill workers. Neglecting the impact of labor supply leads us to overestimate the offer wages of nonworkers, which in turn contributes to a conservative estimate of the sample selection effect.

Although the analysis is subject to offsetting biases, it is unclear if any of these effects will dominate. Still the analysis goes further than earlier work by introducing more direct information about the wages of those who are incarcerated and by accounting for uncertainty in unobserved mean wages of nonworkers and inmates.

RESULTS

Table 5 details the wage adjustment in 1999 among men ages 22–64 and men ages 22–30. Matching workers' wages by age and education to those of nonworkers and inmates reduces the mean for whites by .012 log points from 2.763 to 2.751. Among working-age blacks, the AE adjustment reduces mean wages by .034 log points. Accounting for the relatively low rate of employment among black men thus increases the estimated black-white wage gap by 7.5% from .302 to .325 log points. By simulating the full predictive distribution for observed and adjusted mean wages we can also calculate standard errors and confidence intervals for all functions of mean wages, including the adjusted wage differential and the selection effect, $100 \times (\bar{d} - \bar{d})/\bar{d}$. The standard error for the selection effect indicates that we can be highly confident that the AE adjustment yields a mean wage gap that is larger than the observed mean wage gap.

The introduction of correctional survey data to impute the wages of inmates substantially increases the adjustment for sample selectivity. Among working-age men, the AEI adjustment lowers the mean wage of whites by .016 log points. Black men's mean wages are reduced by .057 log points, indicating the extreme economic marginality of criminal offenders reflected in the correctional surveys. Because the wage adjustment for black men is so large, the black-white wage gap is estimated to increase by one-fifth if we account for the economic status of nonworkers and those incarcerated.

Because conventional joblessness and incarceration rates are much higher among black men in their 20s, the lower half of table 5 shows that sample selection effects are large for young men. The AE adjustment increases the observed racial gap in wages among young men by 15.8%. Standard errors are larger because sample sizes are smaller, but a confidence interval for the AE selection effect for young men still excludes

TABLE 5
OBSERVED AND ADJUSTED LOG MEAN EARNINGS AND SAMPLE
SELECTION EFFECTS, 1999

	Whites	Blacks	Difference	Selection Effect (%)
Men ages 22–64:				
Observed earnings ...	2.763 (.001)	2.461 (.004)	.302 (.004)	
AE adjustment	2.751 (.001)	2.427 (.004)	.325 (.004)	7.5 (1.9)
AEI adjustment	2.747 (.001)	2.384 (.003)	.364 (.003)	20.3 (1.7)
Men ages 22–30:				
Observed earnings ...	2.460 (.002)	2.291 (.008)	.169 (.008)	
AE adjustment	2.451 (.002)	2.256 (.009)	.195 (.009)	15.8 (7.3)
AEI adjustment	2.445 (.002)	2.178 (.006)	.267 (.007)	58.2 (6.6)

NOTE.—Nos. in parentheses are SEs except where noted otherwise.

zero, indicating that we are 95% certain that the adjusted mean wages exceed the observed mean wage. The AEI adjustment yields extremely large selection effects because incarceration rates for young black men at the end of the 1990s exceeded 10%, and because the preincarceration wages of black men were lower than those for whites. High incarceration rates and low counterfactual wages contribute to a selection effect of nearly 60% for young workers. That is, accounting for the very low earnings potential of incarcerated men increases the estimated wage advantage of whites from 17% to 27%. The small standard error (6.6 percentage points) again indicates that a confidence interval for the selection effect excludes zero.

Time series of the adjusted and observed earnings differentials for all years between 1980 and 1999 are shown in figures 2 and 3. The time series for the observed wage differential indicates that the black-white wage gap for working-age men increased slightly in this period from about .28 to .30 log points (fig. 2). Accounting for increased joblessness among young, low-education men suggests that the relative economic position of black men deteriorated more than is indicated by the observed wage gap. Using workers' wage data to predict age-education wages among the jobless provides an adjusted wage gap that increased from about .28 to .32 log points. This is a conservative estimate of the relative decline in the economic position of black men because we do not account for the unusually low productivity of incarcerated men. The AEI adjustment,

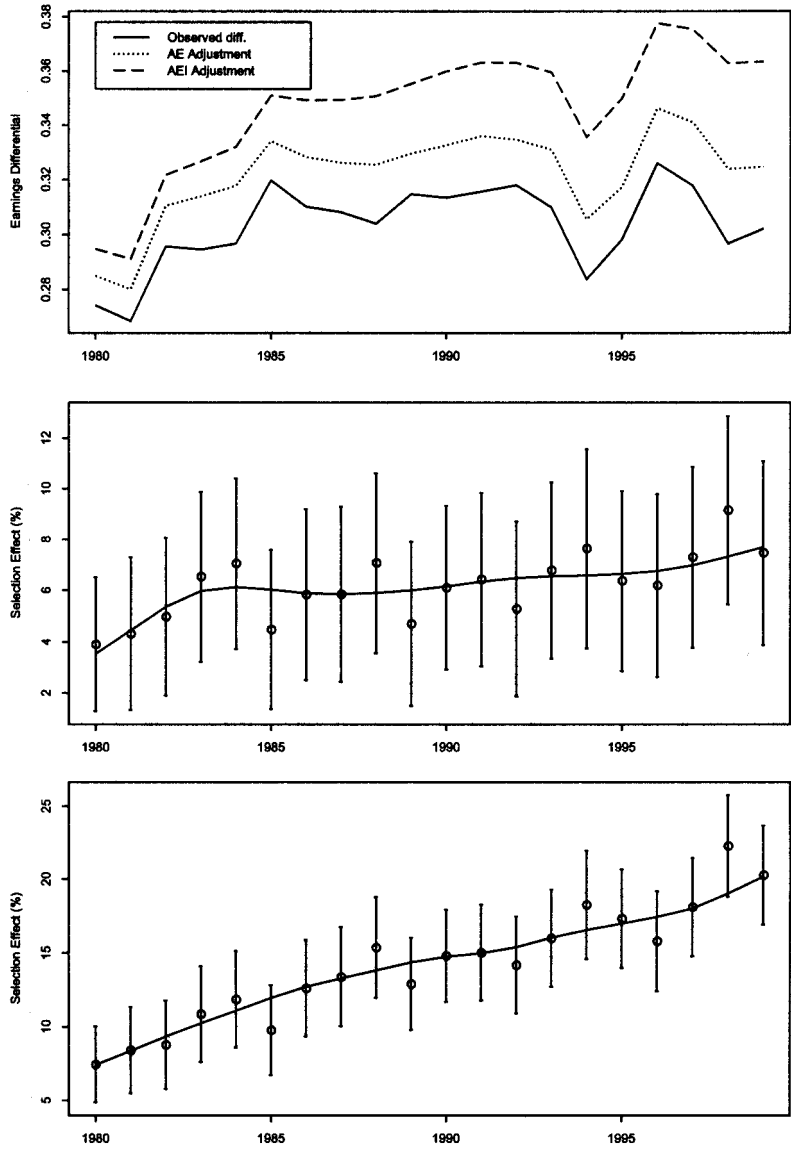


FIG. 2.—The white-black difference in mean log hourly wages, men ages 22–64, 1980–99. *Top panel:* observed earnings differential, \bar{d} , and adjusted differentials, \hat{d} ; *middle panel:* selection effect using the AE adjustment; *bottom panel:* selection effect using the AEI adjustment. A smooth line indicates the trend. The selection effect and 95% confidence intervals are measured as a percentage of the observed difference, \bar{d} .

using correctional survey data, suggests a much larger decline in the relative economic status of working-age black men. With this adjustment, the economic advantage of white men is estimated to have increased from .30 to .36 log points between 1980 and 1999.

The lower panels of figure 2 plot the annual sample selection adjustments as a percentage of the observed earnings differential. These plots also show error bars indicating a 95% confidence interval. The middle panel of figure 2 shows that under the AE adjustment, the sample selection effect of labor inactivity drifts upward from about 4% to 8% of the observed black-white wage gap. Accounting for sampling variation in observed mean wages and prior uncertainty about the counterfactual wages of the jobless yields confidence intervals of about five to seven percentage points, indicating strong evidence that the selection-adjusted wage gap is larger than the observed black-white gap in wages.

The upward trend in the selection effect is clearly indicated once we account for low wages among inmates. The AEI adjustment indicates that declining labor force participation and increasing incarceration rates among black men between 1980 and 1999 increased the white wage advantage from about 5% to 20%. Standard errors in this case are about the same magnitude on the log scale as for the AE adjustment. Because the selection effect is much larger, we are quite sure that the selection-adjusted wage gap exceeds the observed wage gap, and the size of the selection effects increased significantly between 1980 and 1999.

Results for young men, ages 22–30, are shown in figure 3. Observed wage differences suggest that young black men gained on their white counterparts between 1985 and 1999 as the observed difference in mean wages declined from about .25 to .17 log points. The selection analysis suggests that this large improvement in economic status is overstated, as low-wage young black men increasingly withdrew from employment. Under the AE adjustment that imputes CPS wages to the jobless, the selection-adjusted wage differential falls from about .26 to .20 from 1985 to 1999. The AEI adjustment, which uses correctional surveys to correct for the low productivity of inmates, suggests that wage gap falls from .30 to .27, less than half the decline in the black-white wage gap recorded by observed wages. The AEI adjustment suggests that if employment and incarceration rates had remained at 1985 levels, observed racial inequality in wages at the end of the 1990s would be significantly higher because of the low wages earned by low-education and crime-involved men.

Selection effects and 95% confidence intervals for young men are plotted in the lower panels of figure 3. With smaller sample sizes for the analysis of young men, standard errors are larger. The middle panel, showing the trend in the AE adjustment, shows that the selection effect roughly doubles in size from about 7% to 15% of the observed black-white wage gap.

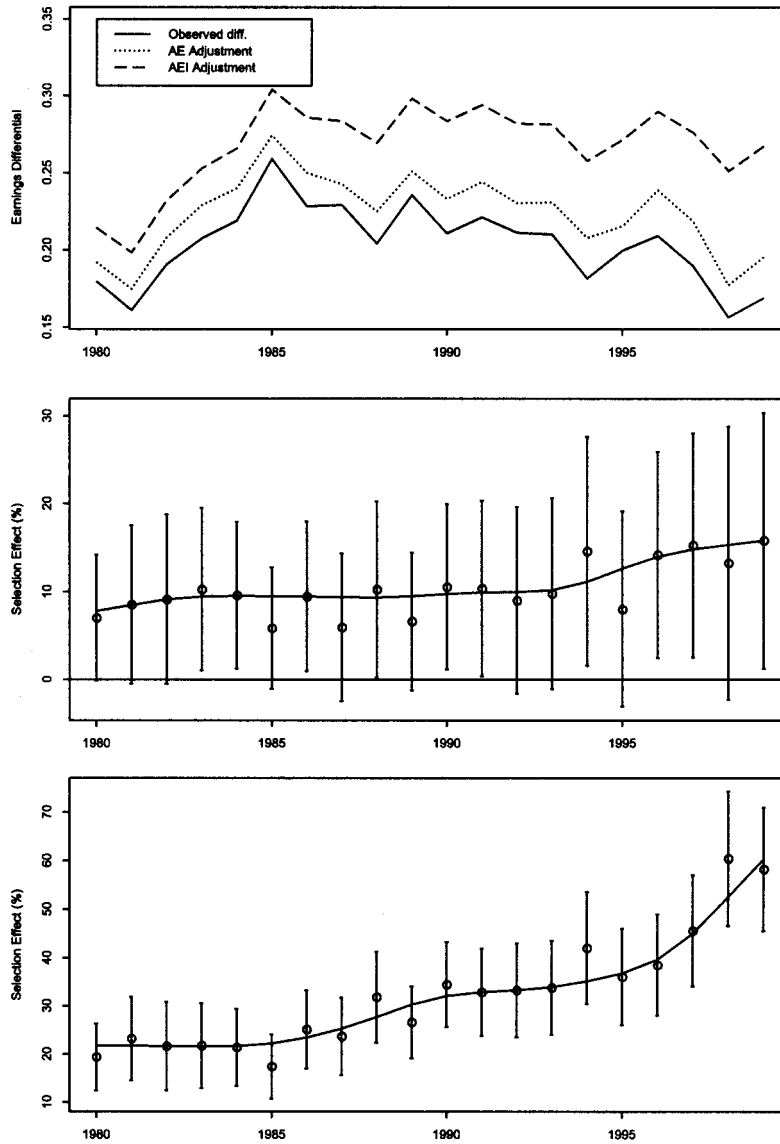


FIG. 3.— The white-black difference in mean log hourly wages, men ages 22–30, 1980–99. *Top panel:* observed earnings differential, \bar{d} , and adjusted differentials, \hat{d} ; *middle panel:* the selection effect excluding inmates; *bottom panel:* selection effect including inmates. A smooth line indicates the trend. The selection effect and 95% confidence intervals are measured as a proportion of the observed difference, \bar{d} .

Confidence intervals are frequently large, regularly overlapping zero in eight years out of the 15 before 1994. From 1994 to 1999, there are only two years, 1995 and 1998, where we cannot be 95% certain that the selection-adjusted wage gap exceeds the observed wage gap.

Using correctional data to allow for the low earnings potential of inmates produces a larger selection effect and a dramatic increase in the effect of sample selection in the two decades from 1980. In the 1980s, the AEI adjustment suggests that accounting for the low economic status of the jobless increased the racial inequality by nearly 20%. By 1999, the selection effect increased threefold to nearly 60%. Confidence intervals for the selection effects are far from zero, indicating that, under the AEI assumptions, we are quite sure that the selection-adjusted wage gap exceeds observed racial inequality in mean wages among young men.

As in all statistical analysis, our conclusions depend on our assumptions. Some of these assumptions are captured by the prior parameters, ψ_1 and ψ_2 , which represent our confidence that the wages of the jobless are described by the wages of workers (for the AE adjustment) and the preincarceration wages of inmates (for the AEI adjustment). Point estimates for the selection effects depend only on the age-education mean wages in the CPS and correctional surveys. Standard errors however, depend on the choice of prior parameters.

The sensitivity of standard errors to priors is reported in table 6. The table reports the average change in standard errors over the 1980–99 period for different choices of ψ_1 , which indexes our uncertainty about nonworkers, and ψ_2 , which indexes uncertainty about prison and the jail inmates. We selected $\psi_1 = \psi_2 = 2$, indicating that we were twice as uncertain as sampling error that our survey data accurately predicted the offer wages of the jobless. If we measure our prior uncertainty with sampling error in the survey data, $\psi_1 = \psi_2 = 1$, standard errors for the selection effects would be about .95 as large as those reported. Standard errors based on the AE adjustment are more sensitive than those based on the AEI adjustment. This reflects the relatively low residual variance of wages in the correctional surveys.

Results in table 6 shows that our main conclusions about the effects of sample selection would only change for the AE adjustment, not the AEI adjustment, if more conservative priors were used. In particular, if ψ_1 is chosen to be much greater than two, we could not confidently conclude with the AE adjustment that the selection effect significantly alters mean wages in the 1980s among working-age men. With this more conservative prior, the confidence interval for the AE adjustment for young men would include zero over the entire 1980–99 period. By contrast, the AEI results are robust to the specification of the prior. Even if we chose prior uncertainty to be six times larger than the sampling error observed in the

TABLE 6
 SENSITIVITY OF SES OF SELECTION-ADJUSTED WAGE DIFFERENTIALS TO VARIATION IN
 PRIOR PARAMETERS, ψ_1 AND ψ_2

	AE ADJUSTMENT			AEI ADJUSTMENT		
	$\psi_1 = 1$	$\psi_1 = 2$	$\psi_1 = 6$	$\psi_1 = 1$	$\psi_2 = 2$	$\psi_1 = 6$
Men ages 22–64:						
$\psi_2 = 1$ .....	.95	.98	1.24	.95	.99	1.19
$\psi_2 = 2$ .....	.95	1.00	1.41	.95	1.00	1.31
$\psi_2 = 6$ .....	.95	1.01	1.55	.98	1.01	1.42
Men ages 22–30:						
$\psi_2 = 1$ .....	.94	.98	1.28	.95	.99	1.19
$\psi_2 = 2$ .....	.94	1.00	1.49	.95	1.00	1.31
$\psi_2 = 6$ .....	.94	1.02	1.64	.98	1.02	1.42

CPS and correctional surveys, we could still be 95% certain that the selection-adjusted mean exceeds the observed gap in mean wages between black men and white men.

CONCLUSION

Given low rates of employment, are relative wages a good indicator of the economic status of African-American men? Like Mare and Winship (1984), who studied the selection effects of school attendance and military service, we also find that labor force statistics for black men cannot be taken at face value. Our analysis indicates that estimates of mean relative wages of black men are inflated by low rates of labor activity. By 1999, the high rate of black joblessness inflated black relative earnings by between 7% and 20% among working-age men, and by as much 58% among young men. The appearance of strong wage gains for young men between 1985 and 1998 must also be assessed in light of rising joblessness. The analysis suggests that if black employment had been maintained at 1985 levels, black-white wage inequality would have fallen by just 10%, instead of the 30% actually observed.

How do these estimates compare to earlier research? We report larger sample selection effects than do Brown (1984) and Blau and Beller (1992), who find that race differences in employment account for around 10% of the observed wage gap (see also Welch 1990). Our estimates are smaller for the whole population, however, than those reported by Chandra (2003, table 5), in which the adjusted wage gap is as much as 45% larger than the observed wage gap. Our finding that relative black joblessness accounts for about two-thirds of black-white wage convergence between 1985 and 1999 is similar in magnitude to Chandra’s (2003) finding that

86% of wage convergence between 1970 and 1990 is because of selection. In sum, the sample selection effects we estimate are relatively large but still in line with estimates in earlier research.

The effects of sample selection on observed wage inequality are large through the 1990s because black joblessness climbed to very high levels, and a historically large proportion of very low-wage black men were not working because of incarceration. We found that a third of all jobless young black men are in prison or jail compared to just 10% of jobless young white men. Incarceration is a major source of employment inequality, contributing significantly to selection bias in the estimation of black relative wages. Furthermore, the counterfactual wages of incarcerated men are likely to be much lower than the wages observed for men of the same age and education. Correctional survey data showed a weak relationship between inmates' education and their preincarceration wages. The preincarceration wages of black inmates were also much lower than those of white inmates, even when taking into account age and education.

These results point to the pitfalls of using the black-white wage gap as an indicator of the relative economic status of African-Americans in the two decades from 1980. In particular, the analysis suggests that improvements in black relative wages are not substantially because of improvements in the market position of black workers. Instead, jobless rates increased among black low-wage workers, and incarceration rates increased among young black workers, removing those with little earnings power from standard labor market accounts.

Our findings of increasing sample selectivity cast doubt on research suggesting that the 1990s' economic expansion improved the economic position of young African-American men. Freeman and Rodgers (1999) report that local area unemployment rates affect the employment and earnings of young workers, especially young African-American workers after 1996. Our analysis suggests that conventional labor force data, like those analyzed by Freeman and Rodgers (1999), may inaccurately measure labor utilization among young black men because their incarceration rates are so high. This bias grows if we focus on workers with little schooling. Ignoring the sample selection effects induced by low black employment rates can cause overestimates of earnings. The relative gains of young black men in the 1990s may be partly explained by high rates of joblessness and incarceration among young black men.

While our results suggest how the penal system conceals inequality by removing low-wage men from the labor market, this analysis provides only a partial picture of the economic effects of high incarceration rates. Recent cohorts of low-skill minority men who face high risks of incarceration are likely to experience reduced earnings and earnings growth (Western 2002; Nagin and Waldfogel 1998). The penal system may thus

substantially increase sample selectivity by contributing to the joblessness of large numbers of ex-inmates. Incarceration may also contribute to labor market inequality in a more direct way by reducing the earnings of ex-offenders.

More generally, this analysis reassesses the impact of institutional change on black economic progress. Previous research claimed that gains in earnings, particularly since the 1960s, resulted from the positive effects of school desegregation and expanded equal employment opportunity. Changes in state institutions helped reduce racial discrimination, insulating some African-Americans from the negative economic effects of manufacturing decline and residential segregation. However, institutional effects are not unambiguously progressive. We find that the penal system increased inequality in employment, especially among youth. This employment disparity had large measurable effects on observed earnings inequality. Although deprived of economic status in official statistics, the institutionalized population contributes significantly to economic inequality, affecting our assessment of the economic status of African-American men.

APPENDIX A

Data Sources

Labor force data.—The earnings regressions and noninstitutional employment-population ratios were estimated using annual labor force data from the Merged Outgoing Rotation Group files of the Current Population Survey (NBER 2001).

Survey correctional data.—Covariate means for prison and jail inmates and employment-population ratios were estimated using data from the *Survey of Inmates of Federal Correctional Facilities, 1991* (BJS 1994a), the *Survey of Jail Inmates, 1978* (BJS 1997d), the *Survey of Inmates of Local Jails, 1983, 1989, 1996* (BJS 1997a, 1997b, 1999), the *Survey of Inmates of State Correctional Facilities, 1979, 1986, 1991* (BJS 1993, 1994b, 1997c), and the *Survey of Inmates of State and Federal Correctional Facilities, 1997* (BJS 2000). Intersurvey years were interpolated.

Administrative correctional data.—Unpublished annual counts of prison and jail populations for blacks and whites were supplied by the Bureau of Justice Statistics. Jail figures are the estimated overnight count for June 30 each year. The prison population is the count at year's end.

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