CRIME RATES AND LOCAL LABOR MARKET OPPORTUNITIES IN THE UNITED STATES: 1979–1997

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Abstract—The labor market prospects of young, unskilled men fell dramatically in the 1980s and improved in the 1990s. Crime rates show a reverse pattern: increasing during the 1980s and falling in the 1990s. Because young, unskilled men commit most crime, this paper seeks to establish a causal relationship between the two trends. Previous work on the relationship between labor markets and crime focused mainly on the relationship between the unemployment rate and crime, and found inconclusive results. In contrast, this paper examines the impact of both wages and unemployment on crime, and uses instrumental variables to establish causality. We conclude that both wages and unemployment are significantly related to crime, but that wages played a larger role in the crime trends over the last few decades. These results are robust to the inclusion of deterrence variables, controls for simultaneity, and controlling for individual and family characteristics.

I. Introduction

THIS paper examines the degree to which changes in crime rates for the United States from 1979 to 1997 can be explained by changes in the labor market opportunities for those most likely to commit crime. The labor market prospects of young, unskilled men fell dramatically in the 1980s and then improved in the 1990s.[1] Crime rates show a reverse pattern: increasing during the 1980s and falling in the 1990s. Since young, unskilled men commit most crime (Freeman, 1996), a connection between the two trends is suspected.[2] However, this paper is the first to systematically examine whether various measures for the labor market conditions of unskilled men can be linked to the trends in crime.

Economists typically explain crime rates by examining how the propensity to commit crime responds to the expected costs and benefits of illegal activity (Becker, 1968; Ehrlich, 1973, 1981, 1996; Levitt, 1997). This study focuses on the indirect costs to crime: the opportunity cost of working in the legal sector. The existing empirical literature has found moderate, but often inconclusive evidence that unemployment rates are positively associated with crime.[3] This paper differs from the existing literature in three ways. First, this paper is the first to look at whether local crime rates are responsive to the labor market conditions of those most likely to commit crime—unskilled men—rather than looking at whether crime rates respond to the general economic conditions of the area. Second, instead of concentrating only on the unemployment rate, we also measure the labor market prospects of potential criminals with the wages of low-skilled workers. Third, we establish a causal connection between crime and labor market conditions, which the existing literature fails to do.

The fact that the effect of wages on crime has largely been ignored in the literature is surprising because wages may be a better measure for the labor market prospects of potential criminals. Unemployment is often short-lived and highly cyclical. Given the potentially long-lasting effects of incarceration and investing in human capital specific to the criminal sector, crime should be more responsive to long-term changes in labor market conditions than to short-term fluctuations. A secular decline in unskilled wages, as seen during the 1970s and 1980s, represents a decline in the "permanent" wages of uneducated workers, whereas cyclical unemployment fluctuations have more temporary implications.

Although Freeman (1996), Wilson (1996), and Raphael and Winter-Ebmer (2001) speculated that the declining wages and employment opportunities of unskilled men contributed to their increasing involvement in crime, Grogger's (1998) is the only paper to examine the relationship between wages and crime.[4] Grogger used a structural model with individual-level data from the NLSY, and estimates the relationship between the wage offer and the property crimes committed by the individual. In contrast, we focus on a variety of property and violent crimes, and use a nonstructural approach that exploits the differences in the timing of wage changes across geographic areas to explain the timing of the changes in various types of crime.[5] Despite the

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[1] The wages and employment rates of unskilled men fell dramatically from the early 1970s until the early 1990s (Katz & Murphy, 1992; Juhn, 1992).

[2] Wilson (1996) implicated the shifting wage and industrial structure of the economy as a possible explanation for the increasing trends in crime during the 1980s.

[3] Freeman (1983, 1999) reviewed this literature. Freeman and Rodgers (1999) and Papps and Winkleman (2000) presented recent evidence.

[4] Although the focus of their paper is not on wages, Cornwell and Trumbull (1994) included controls for wages in various sectors. However, their paper looks at only counties in North Carolina for seven years, and they aggregate all crimes into one category. We use counties throughout the whole United States for nineteen years and analyze seven types of crime. Also, Lochner (1999) argued that labor market ability, even more than wages, affects crime. Fleisher (1966) and Hashimoto (1987) study the effect of income and the minimum wage on crime, respectively.

[5] Topel (1994) showed that there are very significant differences in local labor market conditions, whereas large variation in crime rates across areas has been shown by Glaeser and Sacerdote (1999), Glaeser, Sacerdote, and Scheinkman (1996), and Levitt (1997).

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marked differences in methods, Grogger's results are generally consistent with those reported here.[6]

Our empirical work consists of three basic analyses: the first two use aggregated data at the county level, and the third incorporates individual-level data. Our first analysis is to run panel regressions using annual, county-level data from 1979 to 1997 with county and time fixed effects. Because wages and unemployment rates for various demographic groups are not available on an annual basis at the county level, we explain the county-level crime rate by focusing on the state-level average wage and unemployment rate of non-college-educated men. This approach exploits year-to-year variation in state-level labor market conditions to explain year-to-year changes in the county-level crime rates.

The second analysis explains the ten-year change (1979–1989) in the county crime rate by the ten-year change in the average wage and unemployment rate of non-college-educated men measured at the metropolitan area (MA) level. This strategy exploits the low-frequency variation in the data. Given the long-term consequences of criminal activity, crime should be more responsive to low-frequency changes in labor market conditions. In addition, the labor market conditions of the MA are a closer match for the labor market conditions of the county than are variables measured at the state level. This long-term regression approach also attenuates measurement error problems in panel regression analyses.[7]

Our third analysis uses individual-level data from the NLSY79 to test whether local labor market conditions can explain individual criminal activity. The NLSY79 permits us to control for a rich set of personal characteristics (such as education, ability, and parental background). After controlling for these variables, we exploit geographical variation in the wages and unemployment rates of unskilled men to explain the criminal behavior of individuals in our sample.

All three strategies indicate that young, unskilled men are responsive to the opportunity costs of crime. However, if specific types of workers or employers migrate in response to increasing crime, changes in the labor market conditions of an area could be endogenous to the change in the local crime rate. To control for this potential endogeneity problem, we use instrumental variables based on the initial industrial composition of the local area, the aggregate industrial trends, and the demographic changes within industries at the aggregate level.[8] Our IV results indicate that endogeneity is not responsible for the significant relationship between the labor market conditions of unskilled workers and the various crime rates. Furthermore, we find that the long-term trends in crime are better explained by the long-term trend in wages than by the trend in the unemployment rate, simply because there is little long-term trend in the unemployment rate, while wages for less educated men fell dramatically over the sample period.

The paper is organized as follows. Section II discusses the general trends in crime rates, wages, and unemployment. Section III presents the panel regressions using annual data. Section IV analyzes the ten-year difference (1979–1989) regression specifications. Section V presents the individual-level data analysis, and section VI concludes.

II. Trends in Crime Rates, Wages, and Unemployment

The aggregate crime data, reported to the FBI by local police authorities, come from the Uniform Crime Reports. Crime rates are offenses per 100,000 people, and the arrest rates are the ratios of arrests to offenses. Offenses and arrests are reported for the individual violent crimes (murder, rape, robbery, and aggravated assault) and property crimes (burglary, larceny, and auto theft). The violent and property crime indices aggregate their respective individual crimes, and the overall crime index aggregates all seven individual crimes. The UCR data are described in more detail in appendix A.

There are many reasons to be wary of self-reported crime data. First, not every crime is reported to the police, and this under-reporting produces measurement error in the offense and arrest rates, which could vary by the type of crime or county of jurisdiction.[9] Also, the methods of collecting and reporting data vary across local authorities. Our inclusion of county fixed effects eliminates the effects of (time-invariant) cross-county variations in reporting methods.[10]

Figure 1 shows the standardized log offense rates for the overall, property crime, and violent crime indices for the entire United States. The property crime index follows a cyclical pattern that peaks in 1980, declines by 17% until 1984, increases by 13% until 1991, and then declines approximately 24% until 1997. The global peak for property crime in 1980 was approximately 4% larger than the local peak in 1991. Property crime increased through the latter half of the 1980s, but the absolute levels were not extraordinary.

Although violent crime is also cyclical, the absolute level is more than 24% larger in 1991 than at the local peak in

[6] Grogger (1998) found that youth behavior is responsive to price incentives and that falling real wages may have been an important determinant of raising youth crime during the 1970s and 1980s.

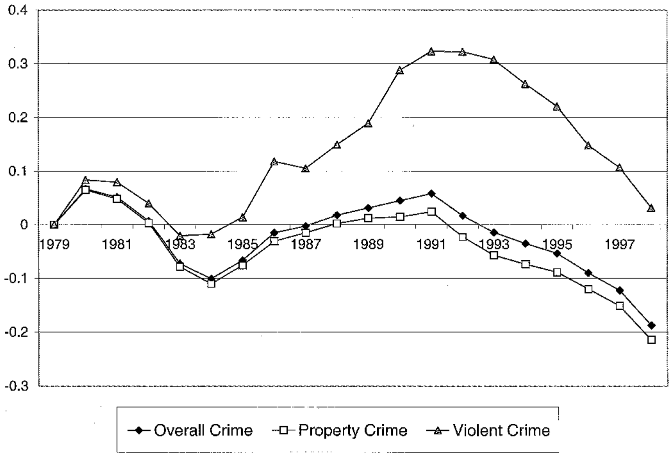
[7] Griliches and Hausman (1986) and Levitt (1995) discussed advantages of the "long regression" in the presence of measurement error.

[8] This IV strategy is an extension of a strategy developed by Bartik (1991) and Blanchard and Katz (1992).

[9] For example, in 1994 the National Criminal Victimization Surveys indicates that 36.1% of rapes, 40.7% of sexual assaults, 55.4% of robberies, 51.6% of aggravated assaults, 26.8% of personal larcenies without contact, 50.5% of the household burglaries, and 78.2% of motor vehicle thefts and theft attempts were reported. Murder, which has virtually no under-reporting, is not subject to this type of bias (*Sourcebook of Criminal Justice Statistics 1995,* table 3.38, p. 250).

[10] Ehrlich (1996) discussed reporting biases in the crime data. One method of addressing it is to work with the logarithms of the crime rates, which are likely to be proportional to the true crime rates. We use this strategy in this paper.

FIGURE 1.—UNITED STATES NATIONAL TRENDS IN CRIME INDICES 1979–1998



Plotted values are the log offense rate (offenses per 100,000 people) relative to the year 1979. The Property Crime index is the sum of auto theft, burglary, and larceny. The Violent Crime Index is the sum of aggravated assault, robbery, murder, and rape. The Overall Crime index is the sum of all property and violent crimes. Data come from the Uniform Crime Reports.

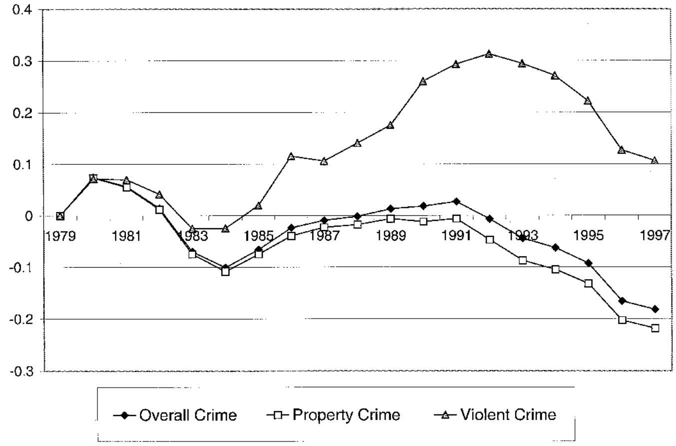
1980. During the whole period, violent crime rose by 32% until 1991, and then steadily declined by 29% as of 1997. Thus, the pattern for violent crime is much more consistent with the common perception of increasing crime through the 1980s and declining since the early 1990s.[11]

In 1997, 88% of all crime was property crime. Therefore, the overall crime rate pattern in figure 1 is almost identical to the property crime rate. Consequently, results for the overall crime index are dominated by the results for the property crime index. The property crime index is dominated by larceny (67%) and burglary (21.3%), and auto theft comprises the remaining 11.7%. Thus, results for the property crime index will be heavily influenced by larceny and burglary. Violent crime is composed mainly of aggravated assault (63%) and robbery (30.5%), whereas rape (6%) and murder (1%) have only a minor influence on the overall violent crime rate. However, the seriousness of these latter two crimes gives them a disproportionate influence over social welfare and public policy.

The trends in our panel sample of 705 counties are displayed in figure 2 and are similar to the national trends in figure 1. The sample consists of all counties with a mean population greater than 25,000 between 1979 and 1997, and at least sixteen out of nineteen years of complete data. The average county population size is 248,017 over the entire period, which covers an average of almost 175 million people per year. The sample selection criteria were designed to capture a representative population while deleting those counties where the reporting accuracy is likely to be unreliable. The size of our sample and the trends displayed in

[11] Murder, which has virtually no measurement error, hit a global peak in 1980 at 10.2 murders per 100,000 people, and never got above 9.8, which was the second peak in 1991.

FIGURE 2.—COUNTY SAMPLE TRENDS IN UNADJUSTED CRIME INDICES



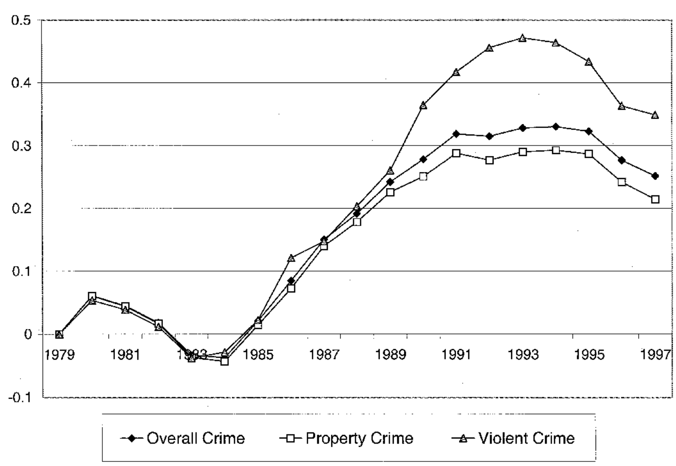
Plotted values are the coefficients on the time dummies from regressions of the log offense rates on time and county dummies for 705 counties with a mean population greater than 25,000 and with at least sixteen out of nineteen years of data (1979–1997). The county population means were used as weights.

figure 2 (in comparison to figure 1) demonstrate that our sample is representative of the entire United States.[12]

So far we have looked only at the raw crime data with no adjustments for changes in the demographic compositions within each county. Figure 3 plots the property and violent crime trends after adjusting for changes in the age, sex, and racial composition. After controlling for these factors, the trends for both types of crime rose steadily throughout the 1980s and declined after the early 1990s. In 1994, the adjusted property crime rate hit a global peak at 23% higher than the local peak in 1980, and 29% higher than it was at the beginning of the period in 1979. The upward trend in unadjusted violent crime found before in figure 2 is now

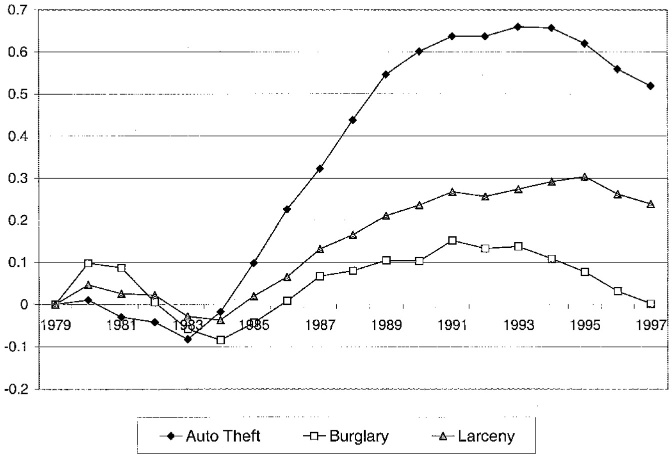
[12] Levitt (1997) showed similar trends using the same data source for 59 large cities.

FIGURE 3.—COUNTY SAMPLE TRENDS IN ADJUSTED CRIME INDICES



Plotted values are the coefficients on the time dummies of regressions of the log offense rates on time dummies, county fixed effects, and controls for age distribution (using the percentage of the population in five different age groups), the sex composition, the percentage of the population that is black, and the percentage that is neither white nor black. The sample consists of 705 counties with a mean population greater than 25,000 and with at least sixteen out of nineteen years of data (1979–1997). The county population means were used as weights.

FIGURE 4.—COUNTY SAMPLE TRENDS IN ADJUSTED PROPERTY CRIMES

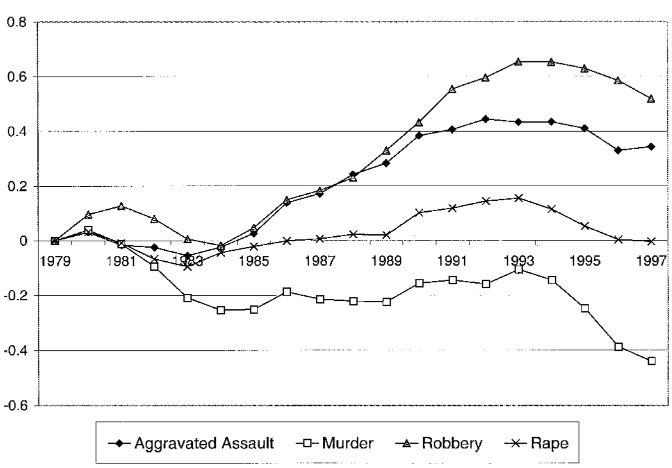


See notes to Figure 3.

accentuated as the adjusted rate rose by over 47% until 1993, and then declined 12% through 1997. The individual property and violent crimes (adjusted for changes in demographics) are depicted in figure 4 and 5.

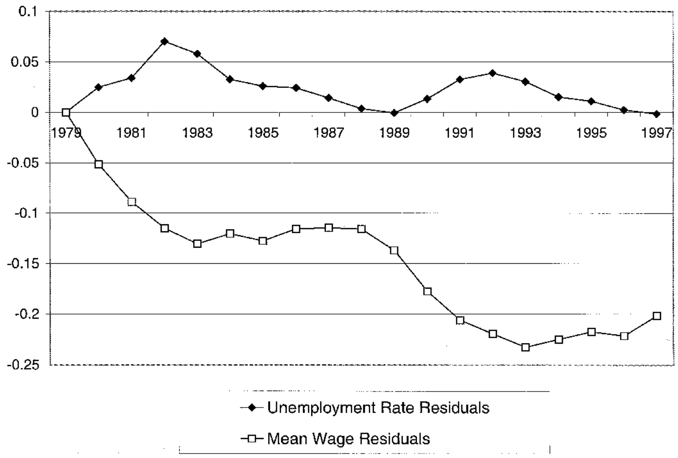
Figure 3 demonstrates that changes in demographics explain much of the decline in both types of crime during the 1990s. Without these controls, the unadjusted property and violent crime indices peaked in 1991 and 1992, respectively. With these controls, they peaked later in 1994 and 1993, respectively (at 29% and 47% higher than in 1979). From 1993 to 1997, adjusted property crime decreased by 7.6% and adjusted violent crime by 12.3%. Even as of 1997, the adjusted property and violent crime rates were still larger (by 21% and 35%, respectively) than they were in 1979. Although the trends have reversed since the mid-1990s, the secular trend in crime over the entire period is clearly upward. While this was happening, the labor market prospects for young, unskilled men deteriorated. Figure 6 plots the average wages of non-college-educated, male workers (workers with only a high school degree or less)

FIGURE 5.—COUNTY SAMPLE TRENDS IN ADJUSTED VIOLENT CRIMES



See notes to Figure 3.

FIGURE 6.—STANDARDIZED WAGES AND UNEMPLOYMENT RATES OF NON-COLLEGE-EDUCATED MEN



The data were computed from the CPS. Non-college-educated mean are defined as full-time men between the age of 18 and 65. Residuals were computed after controlling for a quartic in potential experience, years of school (within non-college), race (black and nonwhite, nonblack), Hispanic background, region of residence, and marital status. Wages deflated to 1982–1984 = 100 dollars. Mean residuals for each year were standardized to the base year 1979.

over time. The average wage of non-college-educated men declined by a total of 23% from 1979 to 1993, and then rebounded somewhat until 1997. This overall pattern is almost the mirror image of the crime patterns, and, therefore, this paper seeks to establish whether a causal connection can be established.

The theory behind such a connection is simple: a decline in the wage offer increases the relative payoff of criminal activity, thus inducing workers to substitute away from the legal sector towards the illegal sector. In addition, a lower wage offer may produce an income effect by increasing the need to seek additional sources of income in possibly less desirable and more dangerous ways. A lower wage also reduces the opportunity cost of serving time in prison.[13] The degree to which legal alternatives affect criminal behavior may, however, vary by the type of crime. Some crimes (such as robbery, larceny, burglary, and auto theft) can be used for self-enrichment, whereas other crimes (murder, rape, and assault) are much less likely to yield material gains to the offender.[14] Offenders of the latter crimes are much more likely to be motivated by nonpecuniary considerations.[15]

[13] Also, Lott (1992) argued that reputational sanctions are positively correlated with the wage.

[14] For example, in 1992 the average monetary loss was $483, $840, $1,278, and $4,713 for larceny, robbery, burglary, and auto theft, respectively, compared with average monetary losses of $27 and $89 for rape and murder, as reported in *Crime in the United States 1992*.

[15] Offenders who commit the latter crimes are more likely to derive benefits from interdependencies in utility with the victim. This notion of interdependence of utility between offender and victim for certain crimes is supported by the fact that murder, rape, and assault occur frequently between people who know each other, whereas the victim and offender have no relationship in the vast majority of property crimes. For offenses committed in 1993, the offenders were classified as non-strangers to the victims in 74.2% of rapes, 51.9% of assaults, and 19.9% of robberies (*1994 Sourcebook of Criminal Justice Statistics,* table 3.11, p. 235). Historically, murder victims knew their offenders (Supplementary Homi-

However, it is important to note that only the most severe crime is reported in the UCR data when multiple crimes are committed in the same incident. Therefore, pecuniary motives may lie behind many of the reported assaults when a property crime was also involved. Holding everything else constant, a reduction in legal opportunities should make one more likely to engage in any form of criminal activity, regardless of motives, due to the reduced legal earnings lost while engaging in a criminal career and potentially serving in jail.

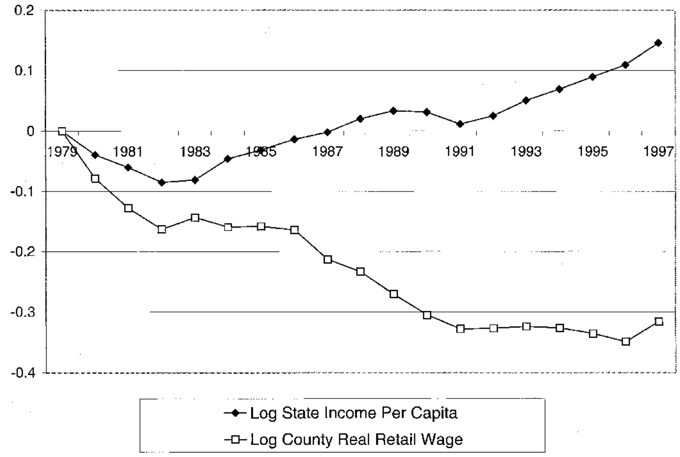
Including the modest increase in the 1990s, figure 6 indicates that the non-college-educated male wage was 20% lower in 1997 than in 1979. This overall trend represents a large long-term decline in the earning prospects of less educated men. In contrast, figure 6 shows that the unemployment rate of non-college-educated men did not suffer a long-term deterioration throughout the period. Although less educated workers suffer the most unemployment, unemployment rates generally follow a cyclical pattern that, by definition, traces out the business cycle. In figure 6, the unemployment rate is the same in 1997 as it was in 1979, although there was variation in the intervening years. Clearly, the unemployment rate affects the labor market prospects of less educated men, but it is hard to discern a long-term deterioration in their legal opportunities by looking at the overall trend in the unemployment rate. The overall decline in the labor market prospects of less educated men, however, is clearly shown by their wages.

The data clearly show that the propensity to commit crime moved inversely to the trends in the labor market conditions for unskilled men. These trends seem to be related, particularly because young, unskilled men are the most likely to commit crime.[16] The goal of the remaining sections is to establish empirically whether the relationship is causal.

III. County-Level Panel Analysis, 1979–1997

This section analyzes a panel sample of 705 counties over nineteen years. The data and trends were described in section II. In each regression, county fixed effects control for much of the cross-sectional variation, and yearly time dummies control for the national trends. The county fixed effects control for unobserved county-level heterogeneity that might be correlated with the county crime rate. Removing the national trend allows us to abstract from any correlation between the aggregate trends in crime and some other unobserved aggregate determinant of crime. Including controls for national trends also controls for aggregate trends in

FIGURE 7.—RETAIL WAGES AND INCOME PER CAPITA OVER TIME



Both variables were computed by the procedure described in Figure 3.

reporting practices. Given the strong inverse relationship between the wage trends of less skilled men and the aggregate crime trends, eliminating the aggregate trend tends to bias the results against finding a relationship between the two phenomena. We expect that the labor market variables can help explain the cross-sectional variation and the national trends, but we identify the effects of these variables from the within-county deviations from the national trends to avoid any spurious correlations.[17] Each specification also controls for changes in the age, sex, and race composition of the county.

Because the wages and unemployment rates of less educated men are not available at the county level, we use these variables measured at the state level to explain the county crime rates. Our wage measure is the mean state residual after regressing individual wages from the CPS on education, experience, experience squared, and controls for race and marital status. The residual state unemployment rate was calculated similarly. The construction of these variables is described in detail in appendix B. Using the residuals allows us to abstract from changes in our measures due to changes in observable characteristics of workers, and thus more accurately reflects changes in the structure of wages and unemployment. However, very similar results are obtained by using the levels rather than the residuals of these variables.

To control for the general level of prosperity in the area, we use log income per capita in the state. As shown in figure 7, income per capita increased steadily since the early 1980s. The impact of this trend on crime, however, is theoretically unclear. If the level of prosperity increases, there is more material wealth to steal, so crime could

cide Reports). During the 1990s, this relationship changed, and now slightly less than half of the murder victims know their offenders. For example, in 1993, 47.7% of all murders were committed by people who were known to the victim, 14.0% were committed by strangers, and in 39.3% of the cases the relationship between victim and offender was unknown (*Crime in the United States 1993,* table 2.12, p. 20).

[16] Freeman (1996) reports that two-thirds of prison inmates in 1991 had not graduated from high school.

[17] Very similar OLS and IV results are obtained when we do not control for county fixed effects. A notable exception is for the larceny category in which unobserved county heterogeneity reverses the sign for the OLS coefficients on our two measures for the labor market prospects of unskilled workers. However, the IV coefficients for larceny have the "expected" sign and are statistically significant.

TABLE 1.—OLS COUNTY-LEVEL PANEL REGRESSIONS FOR VARIOUS OFFENSE RATES USING THE "CORE" SPECIFICATION, 1979–1997

		Property Crime				Violent Crime				
	Overall Crime Index	Property Crime Index	Auto Theft	Burglary	Larceny	Violent Crime Index	Aggravated Assault	Murder	Robbery	Rape
Log state non-college-educated male weekly wage residual	−0.60**	−0.54**	−1.45**	−0.60**	−0.41**	−1.08**	−1.31**	−0.95**	−0.96**	0.10
	(0.13)	(0.14)	(0.24)	(0.17)	(0.14)	(0.15)	(0.18)	(0.25)	(0.22)	(0.17)
	a = 14.1	a = 12.5	a = 33.7	a = 14.0	a = 9.4	a = 25.1	a = 30.4	a = 22.1	a = 22.4	a = −2.2
	b = −1.9	b = −1.7	b = −4.4	b = −1.9	b = −1.2	b = −3.3	b = −4.0	b = −2.9	b = −3.0	b = −0.3
State unemployment rate residual for non-college-educated men	2.22**	2.33**	0.85**	3.10**	2.33**	1.26**	1.08**	−0.80*	2.12**	0.12
	(0.28)	(0.30)	(0.41)	(0.34)	(0.31)	(0.30)	(0.32)	(0.45)	(0.44)	(0.35)
	a = 6.8	a = 7.1	a = 2.3	a = 9.5	a = 7.1	a = 3.8	a = 3.3	a = −2.5	a = 6.5	a = 0.5
	b = −7.1	b = −7.5	b = −2.7	b = −10.0	b = −7.5	b = −4.0	b = −3.5	b = 2.6	b = −6.8	b = −0.4
Log state income per capita	0.54**	0.48**	0.72**	0.60**	0.51**	0.96**	1.18**	0.91**	1.20**	0.86**
	(0.18)	(0.19)	(0.30)	(0.24)	(0.18)	(0.19)	(0.21)	(0.31)	(0.31)	(0.23)
	a = −1.1	a = −0.1	a = −1.4	a = −1.2	a = −1.0	a = −1.9	a = −2.4	a = −1.8	a = −2.4	a = −1.7
	b = 4.0	b = 3.6	b = 5.3	b = 4.4	b = 3.7	b = 7.1	b = 8.7	b = 6.7	b = 8.9	b = 6.4
Observations	12769	12769	12769	12769	12769	12769	12769	12769	12769	12769
Partial R^2	0.04	0.04	0.02	0.05	0.04	0.01	0.01	0.04	0.00	0.01

** indicates that the coefficient is significant at the 5% level. * indicates significance at the 10% level. The standard errors in parentheses have been corrected for a common state-year effect. Numbers after "a =" represent the "predicted" percentage increase of the crime rate due to the mean change in the independent variable, computed by multiplying the coefficient estimate by the mean change in the independent variable between 1979–1993 (multiplied by 100). Numbers after "b =" represent the "predicted" percentage increase in the crime rate based on the mean change in the independent variable during the latter period, 1993–1997. Observations are for 705 counties with at least 16 out of 19 years of data. Regressions include county and time fixed effects and county-level demographic controls (percentage of population age 10–19, age 20–29, age 30–39, age 40–49, and age 50 and over, percentage male, percentage black, and percentage nonblack and nonwhite). Regressions are weighted by the mean population size of each county. Partial R^2 are after controlling for county and time fixed effects and demographic controls.

increase. However, higher income individuals invest more in self-protection from criminals, so crime may decrease.[18] The overall effect, therefore, is an empirical question. By including this measure in our regressions, we answer this question and control for any correlation between the labor market prospects of less educated men and the overall economic prosperity of the area.

Table 1 displays the coefficient estimates for the economic variables in our "core" specification. The standard errors throughout the analysis are corrected for a common unobserved factor underlying crime in each state in each year. All three economic variables are very significant for the property and violent crime indices, and every individual crime rate except for rape. Furthermore, the coefficients have the expected signs: increases in the wages of non-college-educated men reduce the crime rate, and increases in the unemployment rate of non-college-educated men increase the crime rate.[19] The results for income per capita are quite uniformly positive and significant, indicating that improvements in the overall economic condition of the area increase the amount of material wealth available to steal, thus increasing crime rates.

Although the coefficients are statistically significant, we would like to know whether their magnitudes are economically significant. The numbers underneath each standard error indicate the "predicted" effects of each independent variable on the crime rate, based on the coefficient estimate and the mean change in the independent variable over two different time periods. The first number indicates the predicted effects between 1979 and 1993 when the adjusted crime indices increased. (See section II.) The second number is the predicted effect during 1993–1997 when crime fell. From table 1, the 23.3% fall in the wages of unskilled men from 1979 to 1993 "predict" a 12.5% increase in property crime (the coefficient −0.54 multiplied by −23.3) and a 25.1% increase in violent crime (the coefficient −1.08 multiplied by −23.3). The 3.05% increase in unemployment during this early period "predicted" a 7.1% (the coefficient 2.33 times 3.05) increase in property crime and a 3.8% (the coefficient 1.26 times 3.05) increase in violent crime. Therefore, the non-college-educated wage explains 43% of the 29% increase in adjusted property crime during this time period, and 53% of the 47.2% increase in adjusted violent crime. The unemployment rate of non-college-educated men explains 24% of the total increase in property crime and 8% of the increase in violent crime. Clearly, the long-term trend in wages was the dominant factor on crime during this time period.

The declining crime trends in the 1993–1997 period are better explained by the unemployment rate. The adjusted property and violent crime rates fell by 7.6% and 12.3%, respectively. From table 1, the 3.1% increase in the wages of non-college-educated men predict a decrease of 1.7% in property crime and 3.3% in violent crime. The comparable predictions for the 3.1% decline in the unemployment rate are decreases of 7.5% for property crime and 4.0% for violent crime.[20] Although the predicted effects are quite similar for violent crime, the declining crime rates in the 1993–1997 period were more influenced by the unemployment rate than the non-college-educated wage. Whether this

[18] Lott and Mustard (1997) and Ayres and Levitt (1998) showed that self-protection lowers crime by carrying concealed weapons and purchasing Lojack (an auto-theft prevention system), respectively.

[19] These results are robust to the inclusion of the mean state residual wage for all workers as an additional control variable.

[20] Focusing exclusively on the effect of declining unemployment rates during the 1990s on crimes per youth, Freeman and Rodgers (1999) found similar results. They found that a decrease of one percentage point in unemployment lowers crimes per youth by 1.5%, whereas we find that it lowers crimes per capita by 2.33%.

TABLE 2.—OLS COUNTY-LEVEL PANEL REGRESSIONS USING THE "CORE SPECIFICATION" PLUS ARREST RATES AND POLICE SIZE VARIABLES, 1979–1995

		Property Crime				Violent Crime				
	Overall Crime Index	Property Crime Index	Auto Theft	Burglary	Larceny	Violent Crime Index	Aggravated Assault	Murder	Robbery	Rape
Log state non-college-educated male weekly wage residual	−0.52**	−0.40**	−1.40**	−0.56**	−0.22	−0.64**	−0.85**	−0.89**	−0.69**	0.32*
	(0.15)	(0.15)	(0.27)	(0.21)	(0.15)	(0.17)	(0.22)	(0.30)	(0.23)	(0.19)
State unemployment rate residual for non-college-educated men	1.38**	1.32**	−0.82*	2.19**	−1.29**	0.18	0.16	−1.00*	0.39	−0.29
	(0.37)	(0.37)	(0.47)	(0.43)	(0.36)	(0.33)	(0.40)	(0.57)	(0.46)	(0.37)
Log state income per capita	0.01	−0.07	−0.03	−0.05	−0.05	0.02	0.34	1.14**	0.18	0.42*
	(0.21)	(0.21)	(0.33)	(0.27)	(0.20)	(0.20)	(0.24)	(0.30)	(0.31)	(0.24)
County arrest rate	−0.002	−0.01**	−0.01**	−0.01**	−0.01**	−0.004**	−0.003**	−0.002**	−0.006**	−0.004**
	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)	(0.0003)	(0.0003)	(0.0002)	(0.0005)	(0.001)
Log state police expenditures per capita	0.28**	0.30**	0.51**	0.34**	0.26**	0.36**	0.39**	0.23	0.55**	0.04
	(0.10)	(0.10)	(0.176)	(0.11)	(0.10)	(0.11)	(0.14)	(0.16)	(0.13)	(0.10)
Log state police employment per capita	−0.04	−0.02	−0.26	−0.04	0.07	−0.06	0.01	−0.28	0.14	0.45**
	(0.14)	(0.13)	(0.20)	(0.16)	(0.12)	(0.14)	(0.16)	(0.18)	(0.18)	(0.12)
Observations	5979	5979	5979	5979	5979	5979	5979	5979	5979	5979
Partial R^2	0.03	0.03	0.03	0.04	0.00	0.01	0.01	0.01	0.00	0.01

** indicates significance at the 5% level. * indicates significance at the 10% level. The standard errors in parentheses have been corrected for a common state-year effect. Observations are for 371 counties with at least sixteen out of seventeen years of data where the police force variables are available (1979–1995). County mean population is used as weights. See notes to table 1 for other definitions and controls used in the regressions.

trend will continue is improbable, because the recent cyclical drop is likely to be temporary, and, in the future, unemployment will continue to fluctuate with the business cycle. The wage trends, however, can continue to improve and have a lasting impact on the crime trends. This is best exemplified by explaining the increases of 21% and 35% in the adjusted property and violent crime rates over the entire 1979–1997 period. The unemployment rate was virtually unchanged in 1997 from 1979, and therefore explains none of the increase in either crime index. The 20% fall in non-college-educated wages over the entire period predicts a 10.8% increase in property crime and a 21.6% increase in violent crime. These predictions "explain" more than 50% of the long-term trend in both indices, illustrating just how much the long-term crime trends are dominated by the wages of unskilled men as opposed to their unemployment rate.

To see if our wage and unemployment measures in table 1 are picking up changes in the relative supplies of different education groups, we checked if the results are sensitive to the inclusion of variables capturing the local education distribution. The results are practically identical to those in table 1, and therefore, are not presented.[21] Clearly, the results are not due to changes in the education distribution.

The specification in table 2 includes our "core" economic variables plus variables measuring the local level of crime deterrence. Three deterrence measures are used: the county arrest rate, state expenditures per capita on police, and state police employment per capita.[22] Missing values for arrest rates are more numerous than for offense rates, so the sample is reduced to 371 counties that meet our sample selection criteria. In addition, the police variables were available for only the years 1979 to 1995. After including these deterrence variables, the coefficients on the non-college-educated wage remain very significant for property and violent crime, although the magnitudes drop a bit. The unemployment rate remains significant for property crime, but disappears for violent crime.

The arrest rate has a large and significantly negative effect for every classification of crime. Because the numerator of the dependent variable appears in the denominator of the arrest rate (the arrest rate is defined as the ratio of total arrests to total offenses), measurement error in the offense rate leads to a downward bias in the coefficient estimates of the arrest rates ("division bias").[23] In addition, the police size variables are likely to be highly endogenous to the local crime rate, exemplified by the positive coefficient on police expenditures for every crime. Controlling for the endogeneity of these police variables is quite complicated (Levitt, 1997), and is not the focus of this study. Table 2 demonstrates that the results, particularly for the non-college-educated wage, are generally robust to the inclusion of these deterrence measures as well as to the decrease in the sample. To work with the broadest sample possible and avoid the endogeneity and "division-bias" issues of these deterrence variables, the remaining specifications exclude these variables.

[21] We included the percentage of male high school dropouts in the state, percentage of male high school graduates, and percentage of men with some college. The property crime index coefficients (standard errors in parentheses) were −0.53 (0.14) for the non-college-educated male wage residual and 2.15 (0.29) for the non-college-educated unemployment rate residual. For the violent crime index, the respective coefficients were −1.00 (0.15) and 1.29 (0.30). Compared to the results in table 1, which excluded the education distribution variables, the coefficients are almost identical in magnitude and significance, as is also the case for the individual crime categories.

[22] Mustard (forthcoming) showed that, although conviction and sentencing data are theoretically important, they exist for only four or five states. Therefore, we cannot include such data in this analysis.

[23] Levitt (1995) analyzed this issue and why the relationship between arrest rates and offense rates is so strong.

TABLE 3.—IV COUNTY-LEVEL PANEL REGRESSIONS FOR VARIOUS OFFENSE RATES USING THE "CORE" SPECIFICATION, 1979–1997

		Property Crime				Violent Crime				
	Overall Crime Index	Property Crime Index	Auto Theft	Burglary	Larceny	Violent Crime Index	Aggravated Assault	Murder	Robbery	Rape
Log state non-college-educated male weekly wage residual	−1.35*	−1.26*	−2.35	−0.55	−0.83	−2.53**	−4.04**	−2.47**	−1.15	−1.08
	(0.72)	(0.75)	(1.64)	(0.97)	(0.70)	(0.87)	(1.07)	(1.19)	(1.32)	(1.04)
	a = 31.4	a = 29.2	a = 54.8	a = 12.9	a = 19.3	a = 58.9	a = 94.0	a = 57.4	a = 26.8	a = 25.1
	b = −4.2	b = −3.9	b = −7.3	b = −1.7	b = −2.6	b = −7.8	b = −12.4	b = −7.6	b = −3.5	b = −3.3
State unemployment rate residual for non-college-educated men	1.66*	1.68*	−5.29**	2.19*	2.45**	1.60	2.61*	0.47	0.75	2.19
	(1.00)	(1.04)	(2.14)	(1.31)	(0.99)	(1.08)	(1.36)	(1.70)	(1.71)	(1.38)
	a = 5.1	a = 5.1	a = −16.2	a = 6.7	a = 7.5	a = 4.9	a = 8.0	a = 1.4	a = 2.3	a = 6.7
	b = −5.3	b = −5.4	b = 17.0	b = −7.0	b = −7.9	b = −5.1	b = −8.4	b = −1.5	b = −2.4	b = −7.0
Log state income per capita	1.65**	1.54**	2.46**	1.27*	1.24**	2.34**	2.72**	2.23**	3.13**	1.36*
	(0.58)	(0.59)	(1.29)	(0.74)	(0.55)	(0.67)	(0.78)	(0.94)	(1.08)	(0.78)
	a = −3.3	a = −3.1	a = −4.9	a = −2.6	a = −2.5	a = −4.7	a = −5.5	a = −4.5	a = −6.3	a = −2.7
	b = 12.2	b = 11.5	b = 18.2	b = 9.4	b = 9.2	b = 17.4	b = 20.1	b = 16.5	b = 23.2	b = 10.1
Observations	12769	12769	12769	12769	12769	12769	12769	12769	12769	12769

** indicates significance at the 5% level. * indicates significance at the 10% level. The standard errors in parentheses have been corrected for a common state-year effect. Observations are for 705 counties with at least sixteen out of nineteen years of data. As described in the text and in the appendix, the instruments are based on the county-level industrial composition at the beginning of the period. All three "economic" independent variables in the table were instrumented. County mean population is used as weights. See notes to table 1 for other definitions and controls used in the regressions.

Up to now, our results may be contaminated by the endogeneity of crime and observed labor market conditions at the county level. Cullen and Levitt (1996) argued that high-income individuals or employers leave areas with higher or increasing crime rates. On the other hand, Willis (1997) indicated that low-wage employers in the service sector are more likely to relocate due to increasing crime rates. In addition, higher crime may force employers to pay higher wages as a compensating differential to workers (Roback, 1982). Consequently, the direction of the potential bias is not clear. However, it is likely that crime-induced migration will occur mostly across county lines within states rather than across states. High-wage earners may leave the county because of increases in the crime rate, but their decision to leave the state is likely to be exogenous to increases in the local crime rate. To the extent that this is true, our use of state-level wage and unemployment rates to explain county-level crime rates should minimize endogeneity problems. On the other hand, our measures of economic conditions may be estimated with error, which would lead to downward-biased estimates. To control for any remaining sources of potential bias, we employ an instrumental variables strategy.

Our instruments for the economic conditions in each state build on a strategy used by Bartik (1991) and Blanchard and Katz (1992) and interact three sources of variation that are exogenous to the change in crime within each state: (i) the initial industrial composition in the state, (ii) the national industrial composition trends in employment in each industry, and (iii) biased technological change within each industry, as measured by the changes in the demographic composition within each industry at the national level.[24]

An example with two industries provides the intuition behind the instruments. Autos (computers) constitute a large share of employment in Michigan (California). The national employment trends in these industries are markedly different. Therefore, the decline in the auto industry's share of national employment will adversely affect Michigan's demand for labor more than California's. Conversely, the growth of the high-tech sector at the national level translates into a much larger positive effect on California's demand for labor than Michigan's. In addition, if biased technological change causes the auto industry to reduce its employment of unskilled men, this affects the demand for unskilled labor in Michigan more than in California. A formal derivation of the instruments is in appendix D.

We use eight instruments to identify exogenous variation in the three "core" labor market variables. After controlling for the demographic variables, the partial R^2 between our set of instruments and the three labor market variables are 0.16 for the non-college-educated wage, 0.08 for the non-college-educated unemployment rate, and 0.32 for state income per capita.

Table 3 presents the IV results for our "core" specification. The coefficient estimates for all three variables remain statistically significant for the property and violent crime indices, although many of the coefficients for the individual crimes are not significant. The coefficients for the non-college-educated wage tend to be larger than with OLS, whereas the IV coefficients for the non-college-educated unemployment rate are generally a bit smaller. The standard errors are amplified compared to the OLS results because we are using instruments that are only partially correlated with our independent variables. The results indicate that endogeneity issues are not re-

[24] Bartik (1991) and Blanchard and Katz (1992) interacted the first two sources of variation to develop instruments for aggregate labor demand. Because we instrument for labor market conditions of specific demographic groups, we also exploit cross-industry variations in the changes in industrial shares of four demographic groups (gender interacted with educational attainment).

TABLE 4.—OLS COUNTY-LEVEL PANEL REGRESSIONS FOR VARIOUS OFFENSE RATES Using the Retail Wage, 1979–1997

		Property Crime				Violent Crime				
	Overall Crime Index	Property Crime Index	Auto Theft	Burglary	Larceny	Violent Crime Index	Aggravated Assault	Murder	Robbery	Rape
Log county retail income per worker	−0.35**	−0.36**	−0.03	−0.71**	−0.33**	−0.23**	0.01	0.05	−0.48**	−0.68**
	(0.06)	(0.06)	(0.12)	(0.07)	(0.06)	(0.07)	(0.09)	(0.11)	(0.10)	(0.09)
State unemployment rate residual for non-college-educated men	2.12**	2.26**	0.31	3.13**	2.29**	0.94**	0.58*	−1.18**	1.93**	0.40
	(0.28)	(0.29)	(0.41)	(0.33)	(0.30)	(0.29)	(0.32)	(0.43)	(0.42)	(0.34)
Log state income per capita	0.28*	0.28*	−0.35	0.54**	0.38**	0.28*	0.20	0.17	0.74**	1.31**
	(0.16)	(0.16)	(0.27)	(0.20)	(0.16)	(0.16)	(0.17)	(0.24)	(0.26)	(0.17)
Observations	12769	12769	12769	12769	12769	12769	12769	12769	12769	12769
Partial R^2	0.04	0.05	0.002	0.07	0.00	0.005	0.001	0.002	0.00	0.019

** indicates significance at the 5% level. * indicates significance at the 10% level. The standard errors in parentheses have been corrected for a common state-year effect. The excluded education category is the percentage of male college graduates in the state. Observations are for 705 counties with at least sixteen out of nineteen years of data. County mean population is used as weights. See notes to table 1 for other definitions and controls used in the regressions.

sponsible for our OLS results, and that, if there is a bias, the bias is towards zero for the non-college-educated wage coefficients, as would be expected if there is measurement error.[25]

Because county-level wage measures for less educated men are not available on an annual basis, we have been using the non-college-educated wage measured at the state level. Table 4 uses the county-level retail wage instead of the state non-college-educated wage because this is the best proxy available at the county level for the wages of less educated workers.[26] As shown in figure 7, the trend in the retail wage is very similar to the trend in non-college-educated wages in figure 6. Table 4 and 5 present the OLS and IV results using the retail wage. The OLS and IV results using this measure are very significant in both analyses.

The overall panel results indicate that crime responds to local labor market conditions. All three of our core economic variables are statistically significant and have meaningful effects on the levels of crime within a county. The long-term trends in various crimes, however, are mostly influenced by the declining wages of less educated men throughout this period. These results are robust to OLS and IV strategies, and the inclusion of variables for the level of local deterrence and the education distribution.

IV. Analysis of Ten-Year Differences, 1979–1989

This section studies the relationship between crime and economic conditions using changes in these variables over a ten-year period (1979–1989). This strategy emphasizes the low-frequency (long-term) variation in the crime and labor market variables in order to achieve identification. Given the long-term consequences of criminal activity, including human capital investments specific to the illegal sector and the potential for extended periods of incarceration, crime should be more responsive to low-frequency changes in labor market conditions. Given measurement error in our independent variables, long-term changes may suffer less from attenuation bias than estimates based on annual data (Griliches & Hausman, 1986; Levitt, 1995).

The use of two Census years (1979 and 1989) for our endpoints has two further advantages. First, it is possible to estimate measures of labor market conditions for specific demographic groups more precisely from the Census than is possible on an annual basis at the state level. Second, we can better link each county to the appropriate local labor market in which it resides. In most cases, the relevant labor market does not line up precisely with the state of residence either because the state extends well beyond the local labor market or because the local labor market crosses state boundaries. In the Census, we estimate labor market conditions for each county using variables for the SMSA/SCSA in which it lies. Consequently, the sample in this analysis is restricted to those that lie within metropolitan areas.[27] Overall, the sample, which is otherwise similar to the sample

[25] Our IV strategy would raise concerns if the initial industrial composition is affected by the initial level of crime and if the change in crime is correlated with the initial crime level, as would occur in the case of mean reversion in crime rates. However, we note that regional differences in the industrial composition tend to be very stable over time, and most likely do not respond highly to short-term "shocks" to the crime rate. Weinberg (1999) reports a correlation of 0.69 for employment shares of two-digit industries across MAs from 1940 to 1980. We explored this potential problem directly by including the initial crime level interacted with time as an exogenous variable in our IV regressions. The results are similar to those in table 3. For the property crime index, −1.91 and 2.08 are the wage and unemployment coefficients, respectively (compared to −1.26 and 1.68 in table 3). For the violent crime index, the respective coefficients are −3.15 and 1.62 (compared to −2.53 and 1.60 in table 3). Similar to table 3, the wage coefficients are significant for both indices, whereas the unemployment rate is significant for property crime. We also ran IV regressions using instrument sets based on the 1960 and 1970 industrial compositions, again yielding results similar to table 3.

[26] To test whether the retail wage is a good proxy, we performed a ten-year difference regression (1979–1989) using Census data of the average wages of non-college-educated men on the average retail wage at the MA level. The regression yielded a point estimate of 0.78 (standard error = 0.04) and an R^2 of 0.71. Therefore, changes in the retail wage are a powerful proxy for changes in the wages of non-college-educated men. Data on county-level income and employment in the retail sector come from the Regional Economic Information System (REIS) disk from the U.S. Department of Commerce.

[27] We also constructed labor market variables at the county group level. Unfortunately, due to changes in the way the Census identified counties in both years, the 1980 and 1990 samples of county groups are not comparable, introducing noise in our measures. The sample in this section differs from that in the previous section in that it excludes counties that are not

TABLE 5.—IV COUNTY-LEVEL PANEL REGRESSIONS FOR VARIOUS OFFENSE RATES USING THE COUNTY RETAIL WAGE, 1979–1997

		Property Crime				Violent Crime				
	Overall Crime Index	Property Crime Index	Auto Theft	Burglary	Larceny	Violent Crime Index	Aggravated Assault	Murder	Robbery	Rape
Log county retail income per worker	−1.02**	−0.98**	−1.08*	−1.21**	−0.69**	−1.60**	−1.42**	−0.69	−1.77**	−1.85**
	(0.32)	(0.33)	(0.64)	(0.43)	(0.31)	(0.41)	(0.51)	(0.54)	(0.54)	(0.48)
State unemployment rate residual for non-college-educated men	2.00**	2.01**	−5.37**	3.07**	2.72**	1.93*	2.08*	−0.02	1.87	3.42**
	(0.93)	(0.97)	(2.02)	(1.21)	(0.95)	(1.00)	(1.28)	(1.65)	(1.53)	(1.34)
Log state income per capita	1.23**	1.17**	1.39**	1.47**	1.01**	1.40**	0.68*	0.90*	3.19**	1.50**
	(0.31)	(0.32)	(0.62)	(0.39)	(0.29)	(0.35)	(0.39)	(0.54)	(0.53)	(0.39)
Observations	12769	12769	12769	12769	12769	12769	12769	12769	12769	12769

** indicates significance at the 5% level. * indicates significance at the 10% level. The standard errors in parentheses have been corrected for a common state-year effect. Observations are for 705 counties with at least sixteen out of nineteen years of data. As described in the text and in the appendix, the instruments are based on the county-level industrial composition at the beginning of the period. All three "economic" independent variables in the table were instrumented. County mean population is used as weights. See notes to table 1 for other definitions and controls used in the regressions.

used in the annual analysis, contains 564 counties in 198 MAs.[28]

As in the previous analysis, we measure the labor market prospects of potential criminals with the wage and unemployment rate residuals of non-college-educated men. To control for changes in the standard of living on criminal opportunities, the mean log household income in the MA is included. The construction of these variables is discussed in appendix C. The regressions also control for the same set of demographic variables included in the previous section. The estimates presented here are for the ten-year differences of the dependent variables on similar differences in the independent variables. Thus, analogous to the previous section, our estimates are based on cross-county variations in the changes in economic conditions after eliminating time and county fixed effects.

Table 6 presents the OLS results for the indices and individual crimes. We focus on property crimes before considering violent crimes. The wages of non-college-educated men have a large negative effect on property crimes. The estimated elasticities range from −0.940 for larceny to −2.396 for auto theft. The 23% drop in wages for non-college-educated men between 1979 and 1993 predicts a 27% increase in overall property crimes, which is virtually all of the 29% increase in these years. The unemployment rate among non-college men has a large positive effect on property crimes. The estimated responses to an increase of one percentage point in unemployment range between 2.310 and 2.648 percentage points. However, unemployment increased by only 3% over this period, so changes in unemployment rates are responsible for much smaller changes in crime rates, approximately a 10% increase. The large cyclical drop in unemployment from the end of the recession in 1993 to 1997 accounts for a 10% drop in property crimes, compared to the actual decline of 7.6%. The estimates indicate a strong positive effect of household income on crime rates, which is consistent with household income as a measure of criminal opportunities.

With violent crime, the estimates for aggravated assault and robbery are quite similar to those for the property crimes. Given the pecuniary motives for robbery, this similarity is expected and resembles the results in the previous section. Some assaults may occur during property crimes, leading them to share some of the characteristics of property crimes. Because assault and robbery constitute 94% of violent crimes, the violent crime index follows the same pattern. As expected, the crimes with the weakest pecuniary motive (murder and rape) show the weakest relationship between crime and economic conditions. In general, the weak relationship between our economic variables and murder in both analyses (and rape in this analysis) suggests that our conclusions are not due to a spurious correlation between economic conditions and crime rates generally. The decline in wages for less educated men predicts a 19% increase in violent crime between 1979 and 1993, or 40% of the observed 47.2% increase, and increases in their unemployment rate predict a 2.6% increase. Each variable explains between two and three percentage points of the 12.3% decline in violent crime from 1993 to 1997.

Changes in the demographic makeup of the metropolitan areas that are correlated with changes in labor market conditions will bias our estimates. To explore this possibility, the specifications in table 7 include the change in the percentage of households that are headed by women, the change in the poverty rate, and measures for the male education distribution in the metropolitan area. Increases in female-headed households are associated with higher crime rates, but the effect is not consistently statistically significant. Including these variables does little to change the coefficients on the economic variables.

Using the same IV strategy employed in the previous section, we control for the potential endogeneity of local criminal activity and labor market conditions in table 8. After controlling for the demographic variables, the partial R^2 between our set of instruments and the three labor market

in MAs (or are in MAs that are not identified on both the 1980 and 1990 PUMS 5% samples).

[28] The annual analysis included counties with data for at least sixteen of nineteen years; any county missing data in either 1979 or 1989 was deleted from this sample. Results using this sample for an annual panel-level analysis (1979–1997) are similar to those in the previous section, although several counties were deleted due to having missing data for more than three years.

TABLE 6.—OLS TEN-YEAR DIFFERENCE REGRESSION USING THE "CORE" SPECIFICATION, 1979–1989

		Property Crime				Violent Crime				
	Overall Crime Index	Property Crime Index	Auto Theft	Burglary	Larceny	Violent Crime Index	Aggravated Assault	Murder	Robbery	Rape
Change in mean log weekly wage of non-college-educated men in MA (residuals)	−1.125**	−1.141**	−2.396**	−1.076**	−0.940**	−0.823**	−0.874**	0.103	−1.040*	0.797
	(0.380)	(0.403)	(0.582)	(0.415)	(0.412)	(0.368)	(0.419)	(0.749)	(0.632)	(0.497)
	a = 26.2	a = 26.5	a = 55.7	a = 25.0	a = 21.9	a = 19.1	a = 20.3	a = −2.4	a = 24.2	a = −18.5
	b = −3.5	b = −3.5	b = −7.4	b = −3.3	b = −2.9	b = −2.5	b = −2.7	b = 3.0	b = −3.2	b = 2.5
Change in unemployment rate of non-college-educated men in MA (residuals)	2.346**	2.507**	2.310**	2.638**	2.648**	0.856	0.827	0.844	2.306**	−1.624*
	(0.615)	(0.644)	(1.155)	(0.738)	(0.637)	(0.649)	(0.921)	(1.230)	(0.982)	(0.921)
	a = 7.2	a = 7.6	a = 7.0	a = 8.0	a = 8.1	a = 2.6	a = 2.5	a = 2.6	a = 7.0	a = −5.0
	b = −7.5	b = −8.0	b = −7.4	b = −8.5	b = −8.5	b = −2.7	b = −2.7	b = −2.7	b = −7.4	b = 5.2
Change in mean log household income in MA	0.711**	0.694*	2.092**	0.212	0.603	0.775**	1.066**	0.648	0.785	−0.885**
	(0.352)	(0.365)	(0.418)	(0.416)	(0.381)	(0.364)	(0.382)	(0.661)	(0.577)	(0.445)
	a = −1.4	a = −1.4	a = −4.2	a = −0.4	a = −1.2	a = −1.6	a = −2.1	a = −1.3	a = −1.6	a = 1.8
	b = 5.3	b = 5.1	b = 15.5	b = 1.6	b = 4.5	b = 5.7	b = 7.9	b = 4.8	b = 5.8	b = −6.6
Observations	564	564	564	564	564	564	564	564	564	564
R^2	0.094	0.097	0.115	0.085	0.083	0.021	0.019	0.005	0.024	0.014

** indicates significance at the 5% level. * indicates significance at the 10% level. Standard errors in parentheses have been corrected for a common unobserved MA effect. Numbers after "a =" represent the "predicted" percentage increase of the crime rate due to the mean change in the independent variable, computed by multiplying the coefficient estimate by the mean change in the independent variable between 1979–1993 (multiplied by 100). Numbers after "b =" represent the "predicted" percentage increase in the crime rate based on the mean change in the independent variable during the latter period 1993–1997. Dependent variable is log change in the county crime rate from 1979 to 1989. Sample consists of 564 counties in 198 MAs. Regressions include the change in demographic characteristics (percentage of population age 10–19, age 20–29, age 30–39, age 40–49, age 50 and over, percentage male, percentage black, and percentage nonblack and nonwhite). Regressions weighted by mean of population size of each county. Wage and unemployment residuals control for educational attainment, a quartic in potential experience, Hispanic background, black, and marital status.

variables ranges from 0.246 to 0.330.[29] The IV estimates in table 8 for the wage and unemployment rates of non-college-educated men are quite similar to the OLS estimates, indicating that endogeneity is not responsible for these effects. Overall, these IV estimates, like those from the annual sample in the previous section, show strong effects of economic conditions on crime.[30] Among the violent crimes, the IV estimates for robbery and aggravated assault show sign patterns and magnitudes that are generally consistent with the OLS results, although the larger standard errors prevent the estimates from being statistically significant. The IV estimates show no effect of household income on crime, whereas the OLS estimates show a strong relationship, as do the OLS and IV estimates from the annual analysis.

To summarize this section, the use of ten-year changes enables us to exploit the low-frequency relation between wages and crime. Increases in the unemployment rate of non-college-educated men increase property crime, whereas increases in their wages reduce property crime. Violent crimes are less sensitive to economic conditions than are property crimes. Including extensive controls for changes in county characteristics and using IV methods to control for endogeneity has little effect on the relationship between the wages and unemployment rates for less skilled men and crime rates. OLS estimates for ten-year differences are larger than those from annual data, but IV estimates are of similar magnitudes, suggesting that measurement error in the economic variables in the annual analysis may bias these estimates down. Our estimates imply that declines in labor market opportunities of less skilled men were responsible for substantial increases in property crime from 1979 to 1993, and for declines in crime in the following years.

V. Analysis Using Individual-Level Data

The results at the county and MA levels have shown that aggregate crime rates are highly responsive to labor market conditions. Aggregate crime data are attractive because they show how the criminal behavior of the entire local population responds to changes in labor market conditions. In this section, we link individual data on criminal behavior of male youths from the NLSY79 to labor market conditions measured at the state level. The use of individual-level data permits us to include a rich set of individual control variables, such as education, cognitive ability, and parental background, which were not included in the aggregate analysis. The goal is to see whether local labor market conditions still have an effect on each individual, even after controlling for these individual characteristics.

The analysis explains criminal activities by each male such as shoplifting, theft of goods worth less than and more than $50, robbery ("using force to obtain things"), and the fraction of individual income from crime.[31] We focus on these offenses because the NLSY does not ask about murder and rape, and our previous results indicate that crimes with a monetary incentive are more sensitive to changes in wages and employment than other types of crime. The data come

[29] To address the possibility that crime may both affect the initial industrial composition and be correlated with the change in crime, we tried including the initial crime rate as a control variable in each regression, yielding similar results reported here.

[30] The specification in table 8 instruments for all three labor market variables. The coefficient estimates are very similar if we instrument only for either one of the three variables.

[31] The means for the crime variables are 1.24 times for shoplifting: 1 time for stealing goods worth less than $50; 0.41 times for stealing goods worth $50 or more, and 0.32 times for robbery. On average, 5% of the respondent's income was from crime.

TABLE 7.—OLS TEN-YEAR DIFFERENCE REGRESSIONS USING THE "CORE" SPECIFICATION PLUS THE CHANGE IN FEMALE-HEADED HOUSEHOLD, THE POVERTY RATE AND THE, MALE EDUCATION DISTRIBUTION, 1979–1989

	Overall Crime Index	Property Crime: Property Crime Index	Property Crime: Auto Theft	Property Crime: Burglary	Property Crime: Larceny	Violent Crime: Violent Crime Index	Violent Crime: Aggravated Assault	Violent Crime: Murder	Violent Crime: Robbery	Violent Crime: Rape
Change in mean log weekly wage of non-college-educated men in MA (residuals)	−1.858** (0.425)	−1.931** (0.445)	−2.606** (0.730)	−1.918** (0.478)	−1.858** (0.446)	−1.126** (0.464)	−0.977* (0.543)	−0.338 (0.948)	−1.964** (0.724)	0.193 (0.604)
Change in unemployment rate of non-college-educated men in MA (residuals)	3.430** (0.510)	3.682** (0.660)	3.470** (1.281)	3.777** (0.786)	3.865** (0.627)	0.935 (0.737)	0.169 (0.932)	1.685 (1.329)	3.782** (1.081)	−1.135 (0.956)
Change in mean log household income in MA	0.809** (0.374)	0.800** (0.247)	1.637** (0.552)	0.449 (0.439)	0.811** (0.354)	0.962* (0.498)	1.107** (0.636)	0.737 (0.927)	0.987 (0.720)	0.061 (0.576)
Change in percentage of households female headed	2.161 (1.360)	2.314 (1.450)	−2.209 (2.752)	3.747** (1.348)	3.076** (1.488)	1.612 (1.475)	1.000 (1.906)	−2.067 (3.607)	−2.338 (2.393)	5.231** (2.345)
Change in percentage in poverty	−5.202** (1.567)	−5.522** (1.621)	−4.621* (2.690)	−5.946** (1.852)	−5.772** (1.649)	−1.852 (1.551)	0.522 (1.797)	−2.388 (3.392)	−6.670** (2.538)	−1.436 (2.051)
Change in percentage male high school dropout in MA	0.531 (0.682)	0.496 (0.721)	1.697 (1.123)	0.476 (0.774)	0.298 (0.748)	0.662 (0.809)	−0.901 (0.971)	2.438 (1.538)	1.572 (1.149)	0.945 (1.268)
Change in percentage male high school graduate in MA	1.232 (0.753)	1.266* (0.763)	0.543 (1.388)	1.209 (1.035)	1.484* (0.779)	1.402 (1.001)	0.008 (1.278)	4.002** (1.922)	2.616* (1.377)	2.939* (1.678)
Change in percentage male with some college in MA	2.698** (1.054)	2.865** (1.078)	4.039** (1.860)	2.787** (1.371)	2.768** (1.067)	0.628 (0.430)	−3.179* (1.809)	4.786 (2.979)	4.868** (2.050)	3.279 (2.176)
rw15rt Observations	564	564	564	564	564	564	564	564	564	564
R^2	0.138	0.147	0.091	0.116	0.143	0.023	0.014	0.004	0.039	0.002

** indicates significance at the 5% level. * indicates significance at the 10% level. Standard errors in parentheses have been corrected for a common MA effect. Regressions weighted by mean of population size of each county. The excluded education category is the percentage of male college graduates in the MA. See notes to table 6 for other definitions and controls.

from self-reporting of the number of times individuals engaged in various forms of crime during the twelve months prior to the 1980 interview. Although we expect economic conditions to have the greatest effect on less skilled individuals, we calculate average wages and unemployment rates for non-college- and college-educated men in each state (from the 1980 Census), and see if they can explain the criminal activity of each individual. To allow the effects to vary by the education of the individual, we interact labor market conditions (and household income, which is included to capture criminal opportunities) with the respondent's educational attainment. The level of criminal activity of person i is modeled as follows

$$\begin{aligned} Crime_i = {} & \beta_{HS1} HS_i W_{si}^{HS} + \beta_{HS2} HS_i U_{si}^{HS} \\ & + \beta_{HS3} HS_i House\ Inc_{si} + \beta_{COL1} COL_i W_{si}^{COL} \\ & + \beta_{COL2} COL_i U_{si}^{COL} \\ & + \beta_{COL3} COL_i House\ Inc_{si} + \Gamma Z_i + \Theta X_{si} \\ & + \epsilon_i . \end{aligned}$$

HS_i and COL_i are indicator variables for whether the respondent had no more than a high school diploma or some college or more as of May 1, 1979. $House\ Inc_{si}$ denotes the mean log household income in the respondent's state of birth (we use state of birth to avoid endogenous migration), and W_{si}^{HS}, U_{si}^{HS} (W_{si}^{COL}, U_{si}^{COL}) denote the regression-adjusted mean log wage and unemployment rate of high school (college) men in the respondent's state of birth. Our measures of individual characteristics, Z_i, include years of school (within college and non-college), AFQT, mother's education, family income, family size, age, race, and Hispanic background. To control for differences across states that may affect both wages and crime, we also include controls for the demographic characteristics of the respondent's state, X_{si}. These controls consist of the same state demographic controls used throughout the past two sections plus variables capturing the state male education distribution (used in table 7).

Table 9 shows that, for shoplifting and both measures of theft, the economic variables have the expected signs and are generally statistically significant among less educated workers. Thus, lower wages and higher unemployment rates for less educated men raise property crime, as do higher household incomes. Again, the implied effects of the changes in economic conditions on the dependent variables are reported beneath the estimates and standard errors.[32] The patterns are quite similar to those reported in the previous analyses: the predicted wage effects are much larger than

[32] The magnitudes of the implied effects on the dependent variables reported here are not directly comparable to the ones previously reported due to the change in the dependent variable. In the previous analyses, the dependent variable was the crime rate in a county, whereas here it is either the number of times a respondent would commit each crime or the respondent's share of income from crime.

TABLE 8.—IV TEN-YEAR DIFFERENCE REGRESSIONS USING THE "CORE" SPECIFICATION, 1979–1989

		Property Crime				Violent Crime				
	Overall Crime Index	Property Crime Index	Auto Theft	Burglary	Larceny	Violent Crime Index	Aggravated Assault	Murder	Robbery	Rape
Change in mean log weekly wage of non-college-educated men in MA (residuals)	−1.056*	−1.073*	−2.883**	−1.147	−0.724	−0.471	−0.671	0.550	−1.555	2.408**
	(0.592)	(0.602)	(0.842)	(0.746)	(0.588)	(0.730)	(0.806)	(1.297)	(1.092)	(1.048)
	a = 24.6	a = 25.0	a = 67.1	a = 26.7	a = 16.8	a = 11.0	a = 15.6	a = −12.8	a = 36.2	a = −56.0
	b = −3.3	b = −3.3	b = −8.9	b = −3.5	b = −2.2	b = −1.5	b = −2.1	b = −1.7	b = −4.8	b = 7.4
Change in unemployment rate of non-college-educated men in MA (residuals)	2.710**	2.981**	2.810	3.003**	3.071**	1.311	1.920	−0.147	2.854	−1.599
	(0.974)	(0.116)	(1.806)	(1.454)	(1.104)	(1.277)	(1.876)	(2.676)	(1.930)	(2.072)
	a = 8.3	a = 9.1	a = 8.6	a = 9.2	a = 9.4	a = 4.0	a = 5.9	a = −0.4	a = 8.7	a = −4.9
	b = −8.7	b = −9.6	b = −9.0	b = −9.6	b = −9.9	b = −4.2	b = −6.2	b = 0.5	b = −9.2	b = 5.1
Change in mean log household income in MA	0.093	0.073	1.852**	−0.695	−0.041	−0.069	0.589	0.818	0.059	−3.219**
	(0.553)	(0.562)	(0.933)	(0.684)	(0.537)	(0.688)	(0.776)	(1.408)	(1.004)	(1.090)
	a = −0.2	a = −0.1	a = −3.7	a = 1.4	a = 0.1	a = 0.1	a = −1.2	a = −1.6	a = 77.0	a = 6.5
	b = 0.7	b = 0.5	b = 13.7	b = −5.1	b = −0.3	b = −0.5	b = −4.4	b = 6.1	b = 0.4	b = −23.9
Observations	564	564	564	564	564	564	564	564	564	564

** indicates the coefficient is significant at the 5% significance level. * indicates significance at the 10% level. Standard errors in parentheses have been corrected for a common MA effect. Regressions weighted by mean of population size of each county. The coefficients on all three presented independent variables are IV estimates using augmented Bartik-Blanchard-Katz instruments for the change in total labor demand, and in labor demand for four gender-education groups. See notes to table 6 for other definitions and controls.

the predicted unemployment effects for the earlier 1979–1993 period, but the unemployment effects are larger in the 1993–1997 period. As expected, economic conditions have no effect on criminal activity for more highly educated workers.[33] The estimates are typically insignificant and often have unexpected signs. The estimates explaining robbery are insignificant and have the wrong signs: however, robbery is the least common crime in the sample. The results explaining the fraction of total income from crime show the expected pattern for less educated workers and the estimates are statistically significant. A weaker labor market lowers income from legal sources (the denominator) as well as increasing income from crime (the numerator); both factors may contribute to the observed results. Among the other covariates (not reported), age and education are typically significant: crime increases with age in this young sample and decreases with education.[34] The other covariates are generally not significant.

Using the individual characteristics that are available in the NLSY79, it is also possible to assess whether the estimates in the county-level analysis are biased by the lack of individual controls. To explore this issue, we drop many of the individual controls from the NLSY79 analysis (we drop AFQT, mother's education, family income, and family size). Although one would expect larger effects for the economic variables if a failure to control for individual characteristics is responsible for the estimated relationship between labor markets and crime, the estimates for economic conditions remain quite similar.[35] Thus, it appears that our inability to include individual controls in the county-level analyses is not responsible for the relationship between labor market conditions and crime.

The analysis in this section strongly supports our previous findings that labor market conditions are important determinants of criminal behavior. Low-skilled workers are clearly the most affected by the changes in labor market opportunities, and these results are robust to controlling for a wealth of personal and family characteristics.

VI. Conclusion

This paper studies the relationship between crime and the labor market conditions for those most likely to commit crime: less educated men. From 1979 to 1997, the wages of unskilled men fell by 20%, and, despite declines after 1993, the property and violent crime rates (adjusted for changes in demographic characteristics) increased by 21% and 35%, respectively. We employ a variety of strategies to investigate whether these trends can be linked to one another. First, we use a panel data set of counties to examine both the annual changes in crime from 1979 to 1997 and the ten-year changes between the 1980 and 1990 Censuses. Both of these analyses control for county and time fixed effects, as well as potential endogeneity using instrumental variables. We also explain the criminal activity of individuals using microdata from the NLSY79, allowing us to control for individual characteristics that are likely to affect criminal behavior.

Our OLS analysis using annual data from 1979 to 1997 shows that the wage trends explain more than 50% of the increase in both the property and violent crime indices over the sample period. Although the decrease of 3.1 percentage

[33] When labor market conditions for low-education workers are used for both groups, the estimates for college workers remain weak, indicating that the difference between the two groups is not due to the use of separate labor market variables. Estimates based on educational attainment at age 25 are similar to those reported.

[34] Estimates are similar when the sample is restricted to respondents age eighteen and over.

[35] Among less educated workers for the percentage of income from crime, the estimate for the non-college-educated male wage drops in magnitude from −0.210 to −0.204; the non-college-educated male unemployment rate coefficient increases from 0.460 to 0.466, and the state household income coefficient declines from 0.188 to 0.179. It is worth noting that the dropped variables account for more than a quarter of the explanatory power of the model: the R^2 declines from 0.043 to 0.030 when these variables are excluded.

TABLE 9.—INDIVIDUAL-LEVEL ANALYSIS USING THE NLSY79

Dependent variable: Number of times committed each crime:	Shoplifted	Stole Property less than $50	Stole Property more than $50	Robbery	Share of Income From Crime
Mean log weekly wage of non-college-educated men in state (residuals) *respondent HS graduate or less	−9.853**	−8.387**	−2.688	0.726	−0.210**
	(2.736)	(2.600)	(1.578)	(1.098)	(0.049)
	a = 2.292	a = 1.951	a = 0.625	a = −0.169	a = 0.049
	b = −0.303	b = −0.258	b = −0.083	b = 0.022	b = −0.006
Unemployment rate of non-college-educated men in state (residuals) * respondent HS graduate or less	17.900**	12.956**	5.929	3.589	0.460**
	(5.927)	(4.738)	(3.827)	(2.639)	(0.080)
	a = 0.546	a = 0.395	a = 0.181	a = 0.109	a = 0.014
	b = −0.575	b = −0.416	b = −0.190	b = −0.115	b = −0.015
Mean log household income in state * respondent HS graduate or less	6.913**	5.601**	1.171	−1.594	0.188**
	(2.054)	(2.203)	(1.078)	(0.975)	(0.043)
	a = −0.139	a = −0.113	a = −0.024	a = 0.032	a = −0.004
	b = 0.512	b = 0.415	b = 0.087	b = −0.118	b = 0.014
Mean log weekly wage of men with some college in state (residuals) * respondent some college or more	−2.045	−7.520*	2.017**	0.071	0.112
	(3.702)	(3.962)	(1.028)	(1.435)	(0.100)
	a = 0.209	a = 0.769	a = −0.206	a = −0.007	a = −0.011
	b = −0.088	b = −0.325	b = 0.087	b = 0.003	b = 0.005
Unemployment rate of men with some college in state (residuals) * respondent some college or more	−9.522	11.662	−7.390	−0.430	−0.477
	(17.784)	(21.867)	(5.794)	(5.606)	(0.400)
	a = −0.078	a = 0.096	a = −0.061	a = −0.004	a = −0.004
	b = −0.155	b = −0.190	b = 0.120	b = 0.007	b = 0.008
Mean log household income in state * respondent some college or more	2.519	5.154**	−0.516	−0.772	0.020
	(2.108)	(1.988)	(1.120)	(1.171)	(0.064)
	a = −0.051	a = −0.104	a = 0.010	a = 0.016	a = −0.0004
	b = 0.187	b = 0.382	b = −0.038	b = −0.057	b = 0.002
Observations	4585	4585	4585	4585	4585
R^2	0.011	0.012	0.024	0.008	0.043

** indicates significance at the 5% level. * indicates significance at the 10% level. Standard errors correcting for within-state correlation in errors in parentheses. Numbers after "a =" represent the "predicted" increase in the number of times each crime is committed (or the share of income from crime) due to the mean change in the independent variable, computed by multiplying the coefficient estimate by the mean change in the independent variable between 1979–1993. Numbers after "b =" represent the "predicted" increase in the number of times each crime is committed (the share of income from crime) based on the mean change in the independent variable during the latter period 1993–1997. Dependent variables are self-reports of the number of times each crime was committed/fraction of income from crime in the past year. Additional individual-level controls include years of completed school (and a dummy variable for some college or more), AFQT, mother's education, log of a three-year average of family income (and a dummy variable for family income missing), log of family size, a quadratic in age, and dummy variables for black and Hispanic background. Additional state-level controls include percentage of population age 10–19, age 20–29, age 30–39, age 40–49, age 50 and over, percentage male, percentage black, percentage nonblack and nonwhite, and the percentage of adult men that are high school dropouts, high school graduates, and have some college. Wage and unemployment residuals control for educational attainment, a quartic in potential experience, Hispanic background, black, and marital status.

points in the unemployment rate of non-college-educated men after 1993 lowered crime rates during this period more than the increase in the wages of non-college-educated men, the long-term crime trend has been unaffected by the unemployment rate because there has been no long-term trend in the unemployment rate. By contrast, the wages of unskilled men show a long-term secular decline over the sample period. Therefore, although crime rates are found to be significantly determined by both the wages and unemployment rates of less educated males, our results indicate that a sustained long-term decrease in crime rates will depend on whether the wages of less skilled men continue to improve. These results are robust to the inclusion of deterrence variables (arrest rates and police expenditures), controls for simultaneity using instrumental variables, both our aggregate and microdata analyses, and controlling for individual and family characteristics.

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APPENDIX A

The UCR Crime Data

The number of arrests and offenses from 1979 to 1997 was obtained from the Federal Bureau of Investigation's Uniform Crime Reporting Program, a cooperative statistical effort of more than 16,000 city, county, and state law enforcement agencies. These agencies voluntarily report the offenses and arrests in their respective jurisdictions. For each crime, the agencies record only the most serious offense during the crime. For instance, if a murder is committed during a bank robbery, only the murder is recorded.

Robbery, burglary, and larceny are often mistaken for each other. Robbery, which includes attempted robbery, is the stealing, taking, or attempting to take anything of value from the care, custody, or control of a person or persons by force, threat of force, or violence, and/or by putting the victim in fear. There are seven types of robbery: street and highway, commercial house, residence, convenience store, gas or service station, bank, and miscellaneous. Burglary is the unlawful entry of a structure to commit a felony or theft. There are three types of burglary: forcible entry, unlawful entry where no force is used, and attempted forcible entry. Larceny is the unlawful taking, carrying, leading, or riding away of property or articles of value from the possession or constructive possession of another. Larceny is not committed by force, violence, or fraud. Attempted larcenies are included. Embezzlement, "con" games, forgery, and worthless checks are excluded. There are nine types of larceny: items taken from motor vehicles, shoplifting, taking motor vehicle accessories, taking from buildings, bicycle theft, pocket picking, purse snatching, theft from coin-operated vending machines, and all others.[36]

When zero crimes were reported for a given crime type, the crime rate was counted as missing and was deleted from the sample for that year, even though sometimes the ICPSR has been unable to distinguish the FBI's legitimate values of 0 from values of 0 that should be missing. The results were similar if we changed these missing values to 0.1 before taking the natural log of the crime rate and including them in the regression. The results were also similar if we deleted any county from our sample that had a missing (or zero reported) crime in any year.

APPENDIX B

Description of the CPS Data

Data from the CPS were used to estimate the wages and unemployment rates for less educated men for the annual, county-level analysis. To construct the CPS data set, we used the merged outgoing rotation group files for 1979–1997. The data on each survey correspond to the week prior to the survey. We employed these data rather than the March CPS because the outgoing rotation groups contain approximately three times as many observations as the March CPS. Unlike the March CPS, nonlabor income is not available on the outgoing rotation groups surveys, which precludes generating a measure that is directly analogous to the household income variable available in the Census.

To estimate the wages of non-college-educated men, we use the log weekly wages after controlling for observable characteristics. We estimate wages for non-college-educated men who worked or held a job in the week prior to the survey. The sample was restricted to those who were between 18 and 65 years old, usually work 35 or more hours a week, and were working in the private sector (not self-employed) or for government (the universe for the earnings questions). To estimate weekly wages, we used the edited earnings per week for workers paid weekly, and used the product of usual weekly hours and the hourly wage for those paid hourly. Those with top-coded weekly earnings were assumed to have earnings 1.5 times the top-code value. All earnings figures were deflated using the CPI-U to 1982–1984 = 100. Workers whose earnings were beneath $35 per week in 1982–1984 terms were deleted from the sample, as were those with imputed values for the earnings questions. Unemployment was estimated using employment status in the week prior to the survey. Individuals who worked or held a job were classified as employed. Individuals who were out of the labor force were deleted from the sample, so only those who were unemployed without a job were classified as unemployed.

To control for changes in the human capital stock of the workforce, we control for observable worker characteristics when estimating the wages

[36] Appendix II of *Crime in the United States* contains these definitions and the definitions of the other offenses.

and unemployment rates of less skilled men. To do this, we ran linear regressions of log weekly wages or, in the case of unemployment status, a dummy variable equal to 1 if the person was unemployed, upon individual worker characteristics: years of completed schooling, a quartic in potential experience, and dummy variables for Hispanic, black, and marital status. We estimate a separate model for each year, which permits the effects of each explanatory variable to change over time. Adjusted wages and unemployment rates in each state were estimated using the state mean residual from these regressions. An advantage of this procedure is that it ensures that our estimates are not affected by national changes in the returns to skill.

The Outgoing Rotation Group data were also used to construct instruments for the wage and unemployment variables as well as the per capita income variable for the 1979–1997 panel analysis. This required estimates of industry employment shares at the national and state levels and the employment shares for each gender-education group within each industry. The sample included all employed persons between 18 and 65. Our classifications include 69 industries at roughly the two-digit level of the SIC. Individuals were weighted using the earnings weight. To minimize sampling error, the initial industry employment shares for each state were estimated using the average of data for 1979, 1980, and 1981.

APPENDIX C

Description of the Census Data

For the ten-year difference analysis, the 5% sample of the 1980 and 1990 Census were used to estimate the mean log weekly wages of non-college-educated men, the unemployment rate of non-college-educated men, and the mean log household income in each MA for 1979 and 1989. The Census was also used to estimate the industrial composition instruments for the ten-year difference analysis. Wage information is from the wage and salary income in the year prior to the survey. For 1980, we restrict the sample to persons between 18 and 65 who worked at least one week, were in the labor force for 40 or more weeks and usually worked 35 or more hours per week. The 1990 census does not provide data on weeks unemployed. To generate an equivalent sample of high labor force attachment individuals, we restrict the sample to people who worked 20 or more weeks in 1989 and who usually worked 35 or more hours per week. People currently enrolled in school were eliminated from the sample in both years. Individuals with positive farm or nonfarm self-employment income were excluded from the sample. Workers who earned less than $40 per week in 1979 dollars and those whose weekly earnings exceeded $2,500 per week were excluded. In the 1980 census, people with top-coded earnings were assumed to have earnings 1.45 times the top-coded value. The 1990 Census imputes individuals with top-coded earnings to the median value for those with top-coded earnings in the state. These values were used. Individuals with imputed earnings (non top-coded), labor force status, or individual characteristics were excluded from the sample.

The mean log household income was estimated using the income reported for the year prior to the survey for persons not living in group quarters. We estimate the employment status of non-college-educated men using the current employment status because the 1990 Census provides no information about weeks unemployed in 1989. The sample is restricted to people between age 18 and 65 not currently enrolled in school. As with the CPS, individuals who worked or who held a job were classified as employed, and people who were out of the labor force were deleted from the sample, so only individuals who were unemployed without a job were classified as unemployed. The procedures used to control for individual characteristics when estimating wages and unemployment rates in the CPS were also used for the Census data.[37]

The industry composition instruments require industry employment shares at the national and MA levels and the employment shares of each gender-education group within each industry. These were estimated from the Census. The sample included all persons between age 18 and 65 not currently enrolled in school who resided in MAs and worked or held a job in the week prior to the survey. Individuals with imputed industry affiliations were dropped from the sample. Our classification has 69 industries at roughly the two-digit level of the SIC. Individuals were weighted using the person weight in the 1990 Census. The 1980 Census is a flat sample.

[37] The 1990 Census categorizes schooling according to the degree earned. Dummy variables were included for each educational category.

APPENDIX D

Construction of the State and MA-Level Instruments

This section outlines the construction of the instruments for labor demand. Two separate sets of instruments were generated, one for economic conditions at the state level for the annual analysis and a second set for economic conditions at the MA level for the ten-year difference analysis. We exploit interstate and intercity variations in industrial composition interacted with industrial differences in growth and technological change favoring particular groups to construct instruments for the change in demand for labor of all workers and workers in particular groups at the state and MA levels. We describe the construction of the MA-level instruments, although the construction of the state-level instruments is analogous.

Let $f_{i|ct}$ denote industry i's share of the employment at time t in city c. This expression can be read as the employment share of industry i conditional on the city and time period. Let $f_{i|t}$ denote industry i's share of the employment at time t for the nation. The growth in industry i's employment nationally between times 0 and 1 is given by

$$GROW_i \equiv \frac{f_{i|1}}{f_{i|0}} - 1.$$

Our instrument for the change in total labor demand in city c is

$$GROW\ TOTAL_c \equiv \Sigma_i f_{i|c0}\ GROW_i.$$

We estimate the growth in total labor demand in city c by taking the weighted average of the national industry growth rates. The weights for each city correspond to the initial industry employment shares in the city. These instruments are analogous to those in Bartik (1991) and Blanchard and Katz (1992).

We also construct instruments for the change in demand for labor in four demographic groups. These instruments extend those developed by Bartik (1991) and Blanchard and Katz (1992) by using changes in the demographic composition within industries to estimate biased technological change toward particular groups. Our groups are defined on the basis of gender and education (non-college-educated and college-educated). Let $f_{g|cti}$ denote demographic group g's share of the employment in industry i at time t in city c ($f_{g|t}$ for the whole nation). Group g's share of the employment in city c at time t is given by

$$f_{g|ct} \equiv \Sigma_i f_{g|cti} f_{i|ci}.$$

The change in group g's share of employment between times 0 and 1 can be decomposed as

$$f_{g|c1} - f_{g|c0} \equiv \Sigma_i f_{g|c0i}\ (f_{i|c1} - f_{i|c0}) + \Sigma_i (f_{g|c1i} - f_{g|c0i}) f_{i|c1}.$$

The first term reflects the effects of industry growth rates, and the second term reflects changes in each group's share of employment within industries. The latter can be thought of as arising from industrial differences in biased technological change.

In estimating each term, we replace the MA-specific variables with analogs constructed from national data. All cross-MA variation in the instruments is due to cross-MA variations in initial industry employment shares. In estimating the effects of industry growth on the demand for labor of each group, we replace the MA-specific employment shares ($f_{g|c0i}$) with national employment shares ($f_{g|0i}$). We also replace the actual end of period shares ($f_{i|c1}$) with estimates ($\hat{f}_{i|ci}$). Our estimate of the growth term is

$$GROW_{gc} \equiv \Sigma_i f_{g|01} \, (\hat{f}_{i|c1} - f_{i|c0}).$$

The date 1 industry employment shares for each MA are estimated using the industry's initial employment share in the MA and the industry's employment growth nationally:

$$\hat{f}_{i|c1} = \frac{f_{i|c0} \; GROW_i}{\Sigma_j f_{j|c0} \; GROW_j}.$$

To estimate the effects of biased technology change, we take the weighted average of the changes in each group's national employment share:

$$TECH_{gc} \equiv \Sigma_i \, (f_{g|1i} - f_{g|0i}) f_{i|c0}.$$

The weights correspond to the industry's initial share of employment in the MA.

APPENDIX E

NLSY79 Sample

This section describes the NLSY79 sample. The sample included all male respondents with valid responses for the variables used in the analysis (the crime questions, education in 1979, AFQT, mother's education, family size, age, and black and Hispanic background; a dummy variable for family income missing was included to include respondents without valid data for family income). The number of times each crime was committed was reported in bracketed intervals. Our codes were as follows: 0 for no times; 1 for one time; 2 for two times; 4 for three to five times; 8 for six to ten times; 20 for eleven to fifty times; and 50 for fifty or more times. Following Grogger (1998), we code the fraction of income from crime as 0 for none; 0.1 for very little, 0.25 for about one-quarter, 0.5 for about one-half, 0.75 for about three-quarters, and 0.9 for almost all.