

Economic Conditions, Deterrence and Juvenile Crime: Evidence from Micro Data

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This article investigates the determinants of criminal activity among juveniles in the United States. It uses a survey of U.S. high school students conducted in 1995, which provides detailed information on offenses; personal, family, and neighborhood characteristics; as well as deterrence measures. The determinants of selling drugs and committing assault, robbery, burglary, and theft are analyzed separately for males and females. The results provide some evidence that juveniles respond to incentives and sanctions. Employment opportunities and policies designed to increase the probability of arrest may be effective tools for reducing juvenile crime.

1. Introduction

The media (*Newsweek*, 1999; *New York Times*, 2001, 2002; *Washington Post*, 1999) have devoted a great deal of attention to exploring the determinants of juvenile crime. Some analysts believe that very little, if anything, can be done to discourage young Americans from participating in illegal activities. DiIulio (1996), for example, argued that today's at-risk

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youth are sufficiently present-oriented that policies aimed at deterring them from committing crimes are doomed to fail. However, the notion of an irrational juvenile criminal who does not respond to incentives is based on anecdotal as opposed to strong empirical evidence. Moreover, it contradicts the economic model of crime developed by Becker (1968) and tested using aggregate data and micro data on the adult population (e.g., Corman and Mocan, 2000, 2005; Cornwell and Trumbull, 1994; Gould, Mustard, and Weinberg, 2002; Levitt, 2002, Witte, 1980). Using state-level data, Levitt (1998) found that the juvenile crime rate is negatively related to the severity of penalties, indicating that the economic model of crime applies to juveniles as well as adults. Furthermore, the sharp increase in the juvenile crime in late 1980s, and the drop in the mid-1990s implies that juvenile crime may be more malleable than suggested.

Investigation of the determinants of juvenile crime is important, not only because of the nature of the problem but also because of the implications of juvenile crime for adolescents' behavior in the future. For example, Mocan, Billups and Overland (forthcoming) show that current criminal activity makes future criminal activity more likely by simultaneously increasing the criminal human capital of the participant and depreciating his legal human capital, and Bound and Freeman (1992) document a negative relationship between criminal participation and labor market attachment, stating that "the growth rate of the population with a criminal record accounts for one third of the longer run erosion of employment [of black male high school dropouts]." In addition, Freeman and Rodgers (2000) show that areas with the most rapidly rising rates of incarceration are areas in which youths, particularly black youths, have had the worst earning and employment experience between the mid-1980s and late 1990s, suggesting a negative relationship between labor market outcomes and a criminal record.

There has been surprisingly little work on the relationship between juvenile crime and sanctions using micro data. Three empirical studies in the economics literature were based on samples composed of juveniles and young adults. Viscusi (1986) analyzed data on 2,358 inner-city black males ages 16 to 24 living in Boston, Chicago, and Philadelphia in 1979. He found that labor market variables were a significant determinant of criminal activity and that those who were not employed or not in school were much more strongly driven by economic incentives to commit crime.

Grogger (1998) used the 1980 National Longitudinal Survey of Youth (NLSY) to investigate the determinants of criminal behavior for 1,134 males ages 14–21 in 1980 and reported that they were responsive to changes in real wages. Tauchen, Witte, and Griesinger (1994) analyzed the criminal activity of 567 men ages 19–25 who were born in Philadelphia in 1945. They found that police budget had a negative impact on the propensity to get arrested during the year.

Although these studies provide interesting insights, they have important limitations. The Viscusi (1986) and Tauchen, Witte, and Griesinger (1994) samples were not nationally representative, and all three papers lacked comprehensive measures of criminal activity and deterrence.¹ Furthermore, none of these works specifically analyzed juvenile delinquency, and neither had data on recent cohorts, around whom the current debate centers. A fourth study in the economics literature is by Levitt and Lochner (2001). Using data from the 1980 NLSY, these authors focused on individuals 15–19 years of age. They found that gender and family background were important determinants of adolescent criminal behavior, but, because of data limitations, they could not assess the impact of legal sanctions.

A number of studies in the criminology literature have examined juvenile behavior at the micro level. Wright et al. (1999) reported that low socioeconomic status promoted delinquency by increasing individuals' alienation, financial strain, and aggression and by decreasing educational and occupational aspirations, whereas high socioeconomic status promoted individuals' delinquency by increasing risk taking and social power and by decreasing conventional values. Ploeger (1997) found a positive relationship between employment and alcohol and drug use for juveniles, which was attributed to exposure to delinquent peers. Smith and Thornberry (1995) documented a positive relationship between child mistreatment and delinquent behavior. Baron and Hartnagel (1997) reported that criminal behavior of homeless male street youths was influenced by

1. In Tauchen and colleagues (1994), criminal activity is measured by being arrested or by a crime seriousness index. In Viscusi (1986) criminal activity is measured by committing any crime; and Grogger (1998) considers only property crimes. Because of data limitations neither Viscusi (1986) nor Grogger (1998) were able to employ measures of deterrence.

drug and alcohol use, criminal peers, and a lack of labor market experience. Wright and Cullen (2001) reported that parental efficacy had a significant impact on adolescent delinquency.

Similar to the research appearing in the economics literature, these papers, too, have limitations. Often, the measure of criminal involvement was based on arrest records or was based on parent/teacher reports (Wright, Cullen, and Williams, 1997). Most used either small samples (e.g., $n = 200$ in Baron and Hartnagel, 1997) or data from a single city or region (e.g., data from Alberta, Canada, in LaGrange and Silverman, 1999; Dunedin, New Zealand, in Wright et al., 1999; Rochester, New York, in Smith and Thornberry, 1995). To our knowledge, no study in this literature has simultaneously controlled for the effects of economic and deterrence variables as well as personal and family characteristics.

An ongoing debate in crime literature is the relative importance of labor market opportunities and criminal sanctions on the level of criminal activity. Freeman (1983, 1999) reviewed a number of studies employing measures of criminal sanctions and labor market conditions. He concluded that sanctions have a greater impact on criminal behavior than do labor market factors: that is, the stick seems to be more effective than the carrot. However, data limitations prevented most research from simultaneously controlling for the impact of labor market variables and sanctions. Micro data sets may contain information on individuals' criminal behavior and their wages and unemployment spells, but they typically lack information on deterrence measures.² Researchers who employ aggregate data sets did not always include extensive deterrence and economic variables (an exception is Corman and Mocan, 2005). As a result, much of the current inference about the relative impact of economic conditions and sanctions is obtained from multiple papers which use different data sets and employ different empirical methods. Information on the importance of deterrence versus labor market conditions is absent for juvenile crime.

In this article we present an analysis of the determinants of juvenile crime using micro data. The nationally representative sample includes

2. In addition to Grogger (1998), another example is Hashimoto (1987), who used arrests as a proxy for crime and investigated the impact of minimum wages on youth crime with no controls for deterrence.

detailed information on offenses; personal, family, and neighborhood characteristics; economic opportunities; as well as deterrence measures. Because individual-level data are used, we are able to estimate the effect of deterrence without the potential confounding influence of incapacitation that necessarily emerges in aggregate data (e.g., Corman and Mocan, 2000; Levitt, 1998). We analyze the determinants of selling drugs, committing assault, robbery, burglary and theft. Our results can be interpreted as providing evidence that juvenile crime is responsive to sanctions and incentives.

2. Data and Descriptive Statistics

The primary data source for this project is the National Longitudinal Study of Adolescent Health Wave I In-home Interview. These data come from nationally representative survey of U.S. students grades 7–12 conducted by the Carolina Population Center at the University of Carolina at Chapel Hill.³ The Wave I In-home Interview was completed by 20,746 adolescents, both males and females, between April and December 1995. After deleting young adults (individuals 18 years of age and older) and observations with missing information, our sample contains 14,942 individuals, the overwhelming majority of whom (96 percent) were between the ages of 13 and 17 at the time of the survey.⁴

Because of confidentiality concerns, respondents' geographical location is not available to researchers using the Adolescent Health study. However, respondents can be matched with county information provided in the Adolescent Health contextual data files. Using these files, we matched

3. It should be noted that our sample excludes individuals not enrolled in high school. In fact, in 1997 about 40% of state prison inmates had not received a high school diploma (Harlow, 2003). If dropouts behave differently than the students sampled by the Adolescent Health study, then our results have the potential to be misleading if applied to the general population, although there is evidence indicating that high school dropouts also respond to incentives (Viscusi, 1986). Similarly, recent research suggests that the effect of dropping out of school on future offending is more complicated than previous research leads one to believe, and that dropping out does not always increase the likelihood of a person's later delinquent involvement (Jarjoura, 1993).

4. The youngest respondents in the sample were 11 years of age, but only 13 individuals (0.08% of the sample) fell into this category.

respondents with a variety of county-level variables, the original sources of which are detailed in Table 1. Descriptive statistics for the independent variables used in the analysis are also provided in Table 1.

The Adolescent Health survey includes a number of questions with regard to delinquent behavior. Specifically, respondents were asked if in the past 12 months they had committed any of the following acts: the selling of drugs, assault, robbery, burglary, or theft. Individuals who replied in the affirmative were then asked whether they engaged in the act on one or two occasions, three or four occasions, or five or more occasions.⁵

Table 2 presents descriptive statistics for the outcome variables used in the analysis. A little over 7% of our sample said that they had sold marijuana or other drugs in the past 12 months; 19.1% indicated that they had assaulted someone; 4.4% had committed robbery; 5.4% had committed burglary; and 5.5% had stolen something worth more than \$50.

Table 3 presents an alternative measure of criminal activity by race and gender: the proportion of the sample who committed *any* of the five crimes listed above in the past year. In keeping with what we know from other studies, black and Native American respondents were more likely to have engaged in criminal activity in the previous year than their white or Asian counterparts. Within each of the racial/ethnic groups represented in Table 3, males were more likely to have participated in criminal activities than their female counterparts. This pattern of results is also in keeping with what we know from previous studies (Gottfredson and Hirshi, 1990; Henggeler, 1989; Horowitz and White, 1987).

It has long been recognized that males commit more crimes than females. Criminologists and sociologists have developed a number of theories to explain the contrast in criminal behavior between the genders. For instance, it has been argued that parents more closely supervise their sons than their daughters (e.g., Hagan, Simpson, and Gillis, 1979). It has also been argued that females have more self-control than males

5. The reliability of self-reported data is well established. Self-reported data and official crime data generally yield similar information (Elliott and Voss, 1974; Hindelang, Hirschi, and Weis, 1981). A comparison of the extent of juvenile crime obtained from our data and the one inferred from official data is presented later in the article.

Table 1. Means and Definitions of Independent Variables

Variable	Sample Mean (SD)	Definition
From: National Longitudinal Study of Adolescent Health		
Female	0.52	Dichotomous variable equal to 1 if female, 0 if male.
Age 14	0.16	Dichotomous variable equal to 1 if respondent was 14 years of age at the time of the interview, equal to 0 otherwise.
Age 15	0.21	Dichotomous variable equal to 1 if respondent was 15 years of age at the time of the interview, equal to 0 otherwise.
Age 16	0.24	Dichotomous variable equal to 1 if the respondent was 16 years of age at the time of the interview, equal to 0 otherwise.
Age 17	0.23	Dichotomous variable equal to 1 if respondent was 17 years of age at the time of the interview, equal to 0 otherwise.
Hispanic	0.17	Dichotomous variable equal to 1 if the respondent said they were of Hispanic or Latino origin, equal to 0 otherwise.
Black	0.23	Dichotomous variable equal to 1 if the respondent said they were black or African American, equal to zero otherwise.
Asian	0.07	Dichotomous variable equal to 1 if the respondent said they were Asian or Pacific Islander, equal to 0 otherwise.
Native American	0.02	Dichotomous variable equal to 1 if the respondent said they were Native American or American Indian, equal to 0 otherwise.
Other Race	0.08	Dichotomous variable equal to 1 if the respondent said they belonged to an unspecified "other" race, equal to 0 otherwise.
Father—No High School	0.10	Dichotomous variable equal to 1 if resident father did not graduate from high school, equal to 0 otherwise.
Father—High School Grad.	0.22	Dichotomous variable equal to 1 if resident father graduated from high school or received a GED, equal to 0 otherwise.
Father—Some College	0.12	Dichotomous variable equal to 1 if the resident father attended college but did not graduate, equal to 0 otherwise.
Father—College Grad.	0.23	Dichotomous variable equal to 1 if the resident father graduated from college, equal to 0 otherwise.
Father—Education Missing	0.34	Dichotomous variable equal to 1 if there was no resident father or if respondent did not know father's schooling, otherwise equal to 0.

(Continued)

Table 1. Continued

Variable	Sample Mean (SD)	Definition
Mother-No High School	0.14	Dichotomous variable equal to 1 if resident mother did not graduate from high school, equal to 0 otherwise.
Mother-High School Grad.	0.32	Dichotomous variable equal to 1 if resident mother graduated from high school or received a GED, equal to 0 otherwise.
Mother-Some College	0.18	Dichotomous variable equal to 1 if the resident mother attended college but did not graduate, equal to 0 otherwise.
Mother-College Grad.	0.27	Dichotomous variable equal to 1 if the resident mother graduated from college, equal to 0 otherwise.
Mother-Education Missing	0.09	Dichotomous variable equal to 1 if there was no resident mother or if respondent did not know mother's level of schooling, otherwise equal to 0.
Two-Parent Family	0.67	Dichotomous variable equal to 1 if the respondent lived with both parents, equal to 0 otherwise.
Parent on Welfare	0.11	Dichotomous variable equal to 1 if either parent received public assistance, and equal to 0 otherwise.
Born Again Christian	0.27	Dichotomous variable equal to 1 if the respondent claimed to be a Born Again Christian, and equal to 0 otherwise.
Catholic	0.26	Dichotomous variable equal to 1 if the respondent claimed to be Catholic, and equal to 0 otherwise.
No Religion	0.12	Dichotomous variable equal to 1 if the respondent claimed no religious beliefs, and equal to 0 otherwise.
Baptist	0.22	Dichotomous variable equal to 1 if respondent said they were Baptist, and equal to 0 otherwise.
From: 1990 Census of Population and Housing		
County Unemployment	0.07 (0.02)	Proportion of the civilian labor force unemployed in the county of residence.
% County Rural	0.23 (0.27)	Proportion of the county population living in a rural area.
% County Urban	0.66 (0.39)	Proportion of the county population living in an urban area.
County Population Density	0.58 (1.52)	Persons per square kilometer in the county of residence.
% County Pop. Black	0.15 (0.14)	Proportion of the county population black.
% County Prop. Hispanic	0.10 (0.14)	Proportion of the county population Hispanic.

From: USA Counties (Bureau of the Census, 1994)

Per Capita Police Spending	90.49 (45.31)	Per capita local government direct general expenditures on police protection in the county of residence, 1987.
Per Capita Welfare Spending	78.41 (103.86)	Per capita local government direct general expenditures on public welfare in the county of residence, 1987.
% Democrat	0.44 (0.10)	Proportion voting Democratic in the 1992 presidential election in the county of residence.
% Ross Perot	0.18 (0.06)	Proportion voting for Perot in the 1992 presidential election in the county of residence.

From: Uniform Crime Reports (FBI, 1994)

County Crime Rate	5,979.04 (2,819.78)	The number crimes in the county per 100,000 persons.
Arrests per Violent Crime	0.46 (0.30)	Total violent crime arrests divided by the number of violent crimes in the county of residence, 1993.

N = 14,942

Table 2. Means and Definitions of Juvenile Offenses

Variable	Definition	Sample Mean
Selling Drugs	In the past 12 months did you . . . sell marijuana or other drugs?	0.074
Assault	. . . hurt someone badly enough to need bandages or care from a doctor or nurse?	0.191
Robbery	. . . use or threaten to use a weapon to get something from someone?	0.044
Burglary	. . . go into a house to steal something?	0.054
Theft	. . . steal something worth more than \$50?	0.055

Based on unweighted responses to the National Longitudinal Study of Adolescent Health, 1995. Sample size = 14,942.

(Gottfredson and Hirschi, 1990) and that they are more risk adverse (Powell and Ansic, 1997).⁶

To account for these differences, we estimate our empirical model separately for males and females, although, in keeping with Grogger (1998) and Viscusi (1986), our primary focus is on male behavior.

6. See also Lau and Williams (1998), who argue that females have lower discount rates, and Schnieder and Lopes (1986), who argue that females have a greater need for security.

Estimates for females are presented in the appendix and are briefly discussed in the text.

3. The Extent of the Problem

Column I of Table 4 presents estimates of the fraction of U.S. high school students who participated in various criminal activities in 1994–95. The figures are based on weighted responses to the Adolescent Health survey. Column II of Table 4 presents similarly constructed criminal participation rates obtained from Wave 3 of the National Youth Survey, conducted in 1979 (Ploeger, 1997).

Table 3. Proportion of Sample Who Committed at Least One Crime in the 12 Months Prior to Being Interviewed in 1995

Race	Male	Female
All races	0.360	0.190
White	0.345	0.169
Black	0.396	0.225
Native American	0.485	0.318
Asian	0.317	0.145
Other	0.307	0.188

Based on unweighted responses to the National Longitudinal Study of Adolescent Health, 1995. Sample size = 14,942.

Table 4. Comparing Measures of Juvenile Criminal Activity

Offense	(I) Participation Rate 1995 Adolescent Health	(II) Participation Rate 1976 National Youth Survey	(III) Number of Juvenile Participants 1995 Adolescent Health	(IV) Number of Offenses Committed by Juvenciles 1995 Adolescent Health	(V) Imputed Number of Juvenile Offenses 1995 Official Sources
Selling drugs	0.070	0.104	1,210,000	3,748,000	—
Assault	0.190	0.042, 0.330*	3,278,000	7,033,000	2,387,000
Robbery	0.042	—	725,000	1,680,000	432,000
Burglary	0.050	0.024	866,000	2,057,000	1,488,000
Theft	0.050	0.026	860,000	2,049,000	3,349,000

See text for more information regarding the Adolescent Health survey. See Ploeger (1997) for details regarding the National Youth Survey. Participation rates based on weighted survey responses.

* The entries in this cell represent the offense rates for “attacking someone,” and “hitting students,” respectively.

A comparison of these survey results suggests that adolescents in the mid-1990s were much more likely to have committed burglary or theft than their counterparts who came of age 15 years earlier. In contrast, the fraction of teens who reported selling drugs in the past year fell from 10.4% to 7%. Unfortunately, it is difficult to gauge the trend in assault because of differences in question wording between the two surveys. Overall this exercise leaves the impression that little headway has been made in combating juvenile crime since the late 1970s.

Using Adolescent Health population weights we can estimate the number of U.S. high school students under the age of 18 who committed a crime in 1994–95. The results, which are presented in column III of Table 4, indicate that 1.2 million adolescents sold drugs and almost 3.3 million assaulted someone. Eight hundred sixty thousand adolescents were involved in theft, 866,000 committed burglary, and 725,000 committed robbery. Because the Adolescent Health data also contain information on the frequency of these offenses, we were able to estimate the total number of crimes committed in each category. If the respondent indicated that he/she committed 1 to 2 offenses, it was converted to 1.5 offenses. A report of 3 to 4 offenses was converted to 3.5 offenses, and 5 or more offenses was converted to 5.5 offenses. Using this algorithm, we calculated the total number of offenses committed for each crime category. The results are reported in column IV of Table 4 and suggest that during the period under study there were 3.7 million drug sales by juveniles, 7 million assaults, 1.7 million robberies, 2 million burglaries, and 2 million thefts.

These numbers can be compared to information obtained from official sources: the Uniform Crime Reports (UCR), published by the FBI, and the National Crime Victimization Survey (NCVS), sponsored by the Bureau of Justice Statistics (column V of Table 4).⁷ This comparison suggests that relying on official arrest and victimization data may

7. To obtain an estimate of juvenile crime in 1995 using these data, we followed the algorithm proposed by Levitt (1998). The number of juvenile crimes is calculated as $[JARR/TARR] \times CRIME$, where *JARR* is juvenile arrests, *TARR* is total arrests, and *CRIME* is the number of total crimes committed in a given category. This algorithm assumes that the proportion of juvenile arrests for a given type of crime is a good proxy for the proportion of juveniles actually committing that type of crime. The arrest information is obtained from the UCR, and the crime information is obtained from the NCVS.

substantially overstate the extent of juvenile theft and understate juvenile assault and robbery.

4. Empirical Model and Results

Following the seminal work of Becker (1968) and its extensions by Ehrlich (1973) and Block and Heineke (1975), we postulate that participation in criminal activity is the result of an optimizing individual's reaction to incentives. More precisely, individuals choose to engage in criminal activities depending on the expected payoffs of the criminal activity, the return to legal labor market activity, tastes, and the costs of criminal activity, such as those associated with apprehension, conviction, and punishment. Using this theoretical framework as a general guide, the empirical model can be depicted as follows:

$$C_{ij}^* = \alpha_j + X_i'\beta_j + Y_i'\gamma_j + Z_i'\delta_j + \varepsilon_{ij}, \quad (1)$$

where C_{ij}^* measures an individual's propensity to engage in a particular crime j . Although an individual's propensity to engage in crime is unobservable, when $C_{ij}^* > 0$ an indicator variable, C_{ij} , can be seen to equal 1, so that: $(C_{ij} = 1) = \text{Prob}(\alpha_j + X_i'\beta_j + Y_i'\gamma_j + Z_i'\delta_j + \varepsilon_{ij} > 0)$. If the error term of equation (1) is normally distributed, then the result is a standard single-equation probit model.

The vector X consists of individual and family characteristics, such as age, race, ethnicity, and religion, parental education, and family structure. The vector Y consists of county characteristics, including per capita welfare spending (which can be thought of as a measure of poverty), the population density, the proportion of population who were black or Hispanic, and the proportion of the population who voted for Ross Perot or the Democratic candidate in the 1992 presidential election. These variables are intended to capture difficult-to-measure cultural and institutional factors that may be correlated with criminal behavior and sanctions (Glaeser, Sacerdote, and Scheinkman, 1996; Sah, 1991).⁸ In addition, following Levitt (1998), we use the total number of crimes in the county per 100,000 population to help

8. Because the geographical location of respondents is not available to researchers working with the Adolescent Health data, we cannot formally control for unobserved regional heterogeneity, which may be correlated with criminal activity and sanctions.

minimize the impact of unobserved factors potentially correlated with our independent variables and criminal activity.

Legal employment opportunities are measured by the county unemployment rate in 1990. Unfortunately, the Adolescent Health contextual files do not provide unemployment data for 1995, the year in which the in-home survey was actually conducted. However, to the extent that there is hysteresis in unemployment, this lag is not a major issue. Also, it might be noted that Freeman and Rodgers (2000) find that past unemployment has an independent effect on the current labor market outcomes of young workers. Although theoretically well defined, the magnitude of the relationship between crime and unemployment has in practice been found to be modest in the economics literature (Corman and Mocan, 2005; Freeman, 1983), whereas the criminology literature provides conflicting evidence on unemployment–crime relationship (Kapusinski, Braithwaite, and Chapman, 1998).

Sanctions, represented by Z in equation (1), are measured by county-level arrests per violent crime. This measure is based on overall, as opposed to juvenile, arrests and crimes, reducing the likelihood of reverse causality from individual criminal activity to the arrest rate. In addition, the arrest data come from 1993, whereas the criminal activity data come from 1995. We assume that an increase in the violent crime arrest rate in 1993 can impact juvenile behavior approximately two years later, but an increase in juvenile crime cannot change the arrest rate two years prior. This approach is similar to that used by Corman and Mocan (2000, 2005) and Levitt (1998) as a solution to potential simultaneity between crime and deterrence. Although employing the overall (as opposed to the juvenile) arrest rate helps avoid simultaneity between crime and deterrence, to the extent that the arrest rate measures deterrence with error we would expect attenuation in the estimated arrest coefficient. The coefficient of the violent crime arrest rate is best interpreted as the impact of general, rather than specific, deterrence.⁹

9. It might be noted that the age of majority, the age at which an individual is treated as an adult by the court system, ranges from 16 to 19, depending on the state. In our data 24% of the students are 16 years of age, and 23% are 17 years of age. However, data restrictions due to confidentiality concerns prevent us from identifying the state of residence, and therefore we do not know which of the respondents would have been treated as an adult by the courts in their state of residence. To the extent that the age of majority is uncorrelated with the state economic conditions and deterrence measures, the estimated impacts of these variables remain unbiased.

Finally, the Adolescent Health data contain information on the amount of per capita local government spending on police protection. Police expenditures are measured in 1987, eight years prior to the behavior we are investigating. This is a long lag, even in the presence of high serial correlation in police spending. Furthermore, this measure of police spending includes not only expenditures on police protection and other crime prevention activities but also activities that have little or no impact on crime, such as traffic safety and vehicular inspection. Measurement error of this nature would likely bias the estimated coefficient of police expenditures toward zero, in effect making it more difficult to find a significant relationship between crime and police spending. Therefore the benchmark model presented next does not include police spending as an independent variable. Inclusion of police spending and arrests per property crime did not change our basic results.

Table 5 presents estimates of criminal participation by males for five different crimes. The principal entries in Table 5 represent marginal effects. Standard errors are corrected to account for the fact that although the unit of observation is the individual, a number of right-hand side variables are measured at the county level.

4.1. Selling Drugs

The first section of Table 5 presents estimates of equation (1) in which C_{ij}^* represents the propensity to sell drugs. All else equal, race and ethnicity seem to be good predictors of the probability that a young male decides to sell drugs. For instance, blacks were about 2 percentage points more likely to sell drugs than whites (the omitted category), whereas Asians were almost 3 percentage points less likely to sell drugs than their white peers. Hispanic origin is associated with an increase in this likelihood of almost 3 percentage points.

As might be expected, age seems to have a positive impact on the likelihood of selling drugs. Fourteen-year-olds were 10 percentage points more likely to sell drugs than those in the 11–13-year age group (the omitted category). Males who were 15, 16, and 17 years of age were 13 percentage points, 15 percentage points, and 16 percentage points more likely, respectively, to sell drugs. These differences are statistically significant at conventional levels.

The results section A of Table 5 suggest that religious beliefs have a strong influence on an individual's willingness to sell drugs. Adolescent

Table 5. Probit Results

Variable	Marginal Effect	SE
A: Determinants of Selling Drugs—Juvenile		
Males		
Black	0.022**	(0.010)
Asian	-0.028**	(0.010)
Native American	0.117***	(0.041)
Other Race	0.015	(0.013)
Hispanic	0.032**	(0.014)
Age 14	0.100***	(0.023)
Age 15	0.127***	(0.021)
Age 16	0.154***	(0.019)
Age 17	0.164***	(0.021)
Born Again Christian	-0.024***	(0.008)
Catholic	-0.010	(0.009)
Baptist	-0.010	(0.011)
No Religion	0.027**	(0.012)
Father—No High School	0.012	(0.016)
Father—High School Grad.	0.006	(0.011)
Father—Some College	0.023	(0.017)
Mother—No High School	0.004	(0.013)
Mother—High School Grad.	0.003	(0.010)
Mother—Some College	0.026**	(0.013)
Father—Education Missing	0.016	(0.015)
Mother—Education Missing	0.019	(0.013)
Two-Parent Family	-0.023*	(0.013)
Parent on Welfare	0.004	(0.010)
County Unemployment	0.356**	(0.191)
Per Capita Welfare Spending	0.0001**	(0.000)
County Population Density	-0.0001***	(0.000)
% County Rural	-0.0009**	(0.000)
% County Urban	-0.0003	(0.000)
% County Pop. Black	-0.001**	(0.001)
% County Pop. Hispanic	-0.002***	(0.000)
% Ross Perot	0.232**	(0.102)
% Democrat	0.176***	(0.050)
County Crime Rate	0.000002	(0.000)
Arrests Per Violent Crime	-0.036**	(0.017)
N = 7,237		
Log likelihood = -2,211.690		
B: Determinants of Assault—Juvenile Males		
Black	0.042**	(0.019)
Asian	-0.016	(0.028)
Native American	0.086*	(0.050)
Other Race	-0.009	(0.019)
Hispanic	0.023	(0.021)
Age 14	0.021	(0.022)
Age 15	0.030	(0.021)

(Continued)

Table 5. Continued

Variable	Marginal Effect	SE
Age 16	0.021	(0.017)
Age 17	0.003	(0.017)
Born Again Christian	-0.032**	(0.015)
Catholic	-0.033	(0.020)
Baptist	-0.011	(0.014)
No Religion	0.013	(0.020)
Father—No High School	0.027	(0.025)
Father—High School Grad.	0.074***	(0.019)
Father—Some College	0.046**	(0.022)
Mother—No High School	0.032	(0.025)
Mother—High School Grad.	0.014	(0.019)
Mother—Some College	0.013	(0.016)
Father—Education Missing	0.063***	(0.023)
Mother—Education Missing	0.007	(0.027)
Two-Parent Family	-0.039**	(0.017)
Parent on Welfare	0.012	(0.018)
County Unemployment	0.317	(0.287)
Per Capita Welfare Spending	0.0002**	(0.000)
County Population Density	-0.00001	(0.000)
% County Rural	0.0003	(0.001)
% County Urban	0.0005	(0.000)
% County Pop. Black	0.001	(0.001)
% County Pop. Hispanic	0.00007	(0.001)
% Ross Perot	0.304**	(0.135)
% Democrat	-0.071	(0.081)
County Crime Rate	-0.000005	(0.000)
Arrests per Violent Crime	-0.066**	(0.032)
N = 7,241		
Log likelihood = -4,143.373		
C: Determinants of Robbery—Juvenile Males		
Black	0.016**	(0.008)
Asian	-0.006	(0.010)
Native American	0.039	(0.031)
Other Race	0.013	(0.013)
Hispanic	0.002	(0.009)
Age 14	0.032**	(0.014)
Age 15	0.036***	(0.013)
Age 16	0.042***	(0.012)
Age 17	0.027**	(0.012)
Born Again Christian	-0.004	(0.007)
Catholic	-0.016**	(0.006)
Baptist	-0.011	(0.008)
No Religion	0.011	(0.009)
Father—No High School	0.014	(0.013)
Father—High School Grad.	0.008	(0.008)
Father—Some College	0.014	(0.010)
Mother—No High School	0.005	(0.011)

Mother—High School Grad.	-0.003	(0.007)
Mother—Some College	-0.006	(0.008)
Father—Education Missing	0.031***	(0.011)
Mother—Education Missing	0.010	(0.010)
Two-Parent Family	0.005	(0.009)
Parent on Welfare	0.024**	(0.011)
County Unemployment	0.285**	(0.131)
Per Capita Welfare Spending	0.00009***	(0.000)
County Population Density	-0.00004**	(0.000)
% County Rural	-0.0005*	(0.000)
% County Urban	-0.00002	(0.000)
% County Pop. Black	0.0003	(0.000)
% County Pop. Hispanic	-0.001**	(0.000)
% Ross Perot	0.022	(0.073)
% Democrat	-0.039	(0.032)
County Crime Rate	-0.000001	(0.000)
Arrests per Violent Crime	-0.005	(0.015)
N = 7,252		
Log likelihood = -1,602.445		
D: Determinants of Burglary—Juvenile Males		
Black	0.0004	(0.010)
Asian	-0.012	(0.010)
Native American	0.053	(0.039)
Other Race	0.029**	(0.015)
Hispanic	-0.016	(0.009)
Age 14	0.030***	(0.013)
Age 15	0.039***	(0.014)
Age 16	0.040***	(0.011)
Age 17	0.018	(0.011)
Born Again Christian	0.006	(0.008)
Catholic	0.003	(0.009)
Baptist	-0.004	(0.009)
No Religion	0.034***	(0.012)
Father—No High School	-0.001	(0.015)
Father—High School Grad.	0.005	(0.010)
Father—Some College	-0.006	(0.011)
Mother—No High School	-0.006	(0.011)
Mother—High School Grad.	-0.006	(0.009)
Mother—Some College	-0.007	(0.010)
Father—Education Missing	0.028**	(0.012)
Mother—Education Missing	0.021**	(0.011)
Two-Parent Family	0.0001	(0.009)
Parent on Welfare	0.029**	(0.014)
County Unemployment	-0.025	(0.189)
Per Capita Welfare Spending	0.00002	(0.000)
County Population Density	-0.00003	(0.000)
% County Rural	-0.0004	(0.000)
% County Urban	-0.0001	(0.000)
% County Pop. Black	-0.0002	(0.000)
% County Pop. Hispanic	0.00009	(0.001)

Table 5. Continued

Variable	Marginal Effect	SE
% Ross Perot	0.033	(0.087)
% Democrat	-0.030	(0.056)
County Crime Rate	-0.000002	(0.000)
Arrests per Violent Crime	-0.006	(0.016)
N = 7,251		
Log likelihood = -1,897.986		
E: Determinants of Theft—Juvenile Males		
Black	-0.003	(0.008)
Asian	-0.009	(0.010)
Native American	0.032	(0.029)
Other Race	0.014	(0.014)
Hispanic	-0.012	(0.010)
Age 14	0.025**	(0.013)
Age 15	0.049***	(0.012)
Age 16	0.053***	(0.012)
Age 17	0.050***	(0.014)
Born Again Christian	-0.005	(0.008)
Catholic	-0.002	(0.008)
Baptist	-0.015 [†]	(0.008)
No Religion	0.032***	(0.014)
Father—No High School	-0.008	(0.012)
Father—High School Grad.	0.005	(0.010)
Father—Some College	0.008	(0.009)
Mother—No High School	0.012	(0.012)
Mother—High School Grad.	0.013 [†]	(0.008)
Mother—Some College	0.013	(0.010)
Father—Education Missing	0.021**	(0.011)
Mother—Education Missing	0.041***	(0.015)
Two-Parent Family	-0.002	(0.009)
Parent on Welfare	0.039***	(0.012)
County Unemployment	0.023	(0.168)
Per Capita Welfare Spending	0.00002	(0.000)
County Population Density	-0.00002	(0.000)
% County Rural	-0.001**	(0.000)
% County Urban	-0.0001	(0.000)
% County Pop. Black	-0.0003	(0.000)
% County Pop. Hispanic	0.0002	(0.000)
% Ross Perot	-0.003	(0.058)
% Democrat	-0.048	(0.036)
County Crime Rate	-0.000001	(0.000)
Arrests per Violent Crime	-0.015	(0.016)
N = 7,254		
Log likelihood = -1,837.698		

Marginal effects reported with Huber-corrected standard errors in parentheses.

[†] Statistically significance at the 10% level;

** at the 5% level,

*** at the 1% level (two-tailed tests).

males who identified themselves as Born Again Christians were 2.4 percentage points less likely to sell drugs than males in the omitted religious category (which consists primarily of individuals who identified themselves as Protestant but not Born Again or Baptist).¹⁰ Males who identified themselves as having no religious beliefs were 2.7 percentage points more likely to engage in the selling of drugs than those in the omitted category.

We are not the first researchers to find that religious beliefs are associated with delinquent behavior. Freeman (1986), for instance, provided evidence that church going is related to adolescent school attendance, work activity and delinquent behavior. Furthermore, it is unclear whether the relationship between religious beliefs and criminal behavior is causal. Because religious beliefs may simply reflect factors omitted from the model, our results should be interpreted with caution.¹¹

A number of the county-level controls are significant in section A of Table 5. For instance, the population density, the percentage of blacks in the county, and the percentage of Hispanics in the county are negatively related to the probability that young males sold drugs. The portion of the vote garnered by the Democratic candidate in the 1992 election and the portion of the vote garnered by Ross Perot in these same elections are positively related to this probability. Interestingly, the estimated coefficient of the county crime rate is extremely small and statistically insignificant at conventional levels, suggesting that simply relying on controls such as the population density and the racial makeup of the county would have been adequate protection against unobserved heterogeneity.

The estimated coefficient of the unemployment rate is positive and statistically significant at the 5% level. This finding is consistent with the idea that young males are more likely to sell drugs when legal employment opportunities are scarce. Also in keeping with the economic model of crime, an increase in the arrest rate for violent crimes is associated with a

10. Baptist and Born Again are not mutually exclusive categories.

11. Following Freeman (1986), we postulate that if religious beliefs are endogenous, then the relationship between the other variables in the vectors X and Y and crime should be similar to the relationship between these variables and religious beliefs. A probit model in which the dependent variable took the value of 1 if the juvenile has no religion and 0 otherwise was estimated using the background variables in equation (1). This exercise produced a different pattern of results than found in the crime regressions, suggesting a causal mechanism from religion to juvenile criminal behavior.

decrease in the probability of selling drugs for juveniles. Specifically, the results suggest that an additional arrest per violent crime in the county of residence is leads to a decrease in the likelihood of selling drugs of 3.6 percentage points.

4.2. Assault

Section B of Table 5 presents estimates of equation (1) in which the propensity to commit assault is the dependent variable. In contrast to the results presented in section A, there is evidence of only a single race/ethnic effect: Black male adolescents were 4.2 percentage points more likely to assaulting someone, holding constant personal, family, and county characteristics. None of the age variables are statistically significant at conventional levels, but respondents who identified themselves as Born Again Christians were 3.2 percentage points less likely to have assaulted someone.

Mother's education seems to have little impact on an individual's propensity to commit assault, but juvenile males whose father only had a high school education were 7.4 percentage points more likely to assault someone as compared to individuals whose father graduated from college. Juvenile males whose father attended but did not finish college were 4.6 percentage points more likely to commit assault. Living in a two-parent household is associated with a 3.9 percentage point decrease in the propensity to commit assault holding the other variables in the model constant.

Poverty in the county of residence, as measured by per capita welfare expenditures, is positively related to the likelihood of committing assault. This finding is consistent with results reported by Corman and Mocan (2000). Although the estimated coefficient of the unemployment rate is not significant at conventional levels, there is evidence to support the deterrence hypothesis: An additional arrest per violent crime is associated with a reduction in the likelihood of assault of 6.6 percentage points.

4.3. Robbery

Section C of Table 5 presents estimates of equation (1) in which the propensity to commit robbery is the dependent variable. Once again, controlling for other factors, being black is associated with an increased risk of participating in illegal activities. Specifically, blacks were 1.6

percentage points more likely to have committed robbery in the past year than their white counterparts.

The estimated coefficients of the age dummies are uniformly significant and range in magnitude from 0.027 to 0.042. Nevertheless, we cannot reject the hypothesis that they are, in a statistical sense, equal. This pattern of results suggests that once males reach the age of 14, their probability of committing robbery remains fairly constant. Males under the age of 14 are less likely to commit robbery than their older peers.

Males who lived in a two-parent family were as likely to have committed robbery as males who lived in nontraditional households. However, coming from a family that received public assistance is associated with an increase in the propensity to commit robbery of 2.4 percentage points.

A one percentage point increase in the unemployment rate is associated with a 0.28 percent point increase in the likelihood of committing a robbery. This result, and the positive relationship between per capita welfare spending and robbery, once again demonstrate the importance of economic conditions. However, the estimates presented in section C of Table 5 provide no evidence of a deterrence effect: The estimated coefficient of the violent crime arrest rate is less than a tenth the size of the coefficient reported in section B and is not statistically significant at conventional levels.

4.4. Burglary

Section D of Table 5 presents estimates of equation (1) in which the propensity to commit burglary is the dependent variable. Juvenile males belonging to the "other race" category had a higher propensity to burglarize in comparison to whites. Having no religious beliefs is associated with an increase in the propensity to commit burglary of 3.4 percentage points. County characteristics, including unemployment and per capita welfare spending, seem to have little impact on burglary, but the coefficient of the welfare receipt variable is significant: Juvenile males from households that received government support were almost 3 percentage points more likely to commit burglary than juvenile males from more affluent households. The coefficient of arrests per violent crime is negative and similar in magnitude to that found in the robbery equation, but it is not statistically significantly different from zero.

4.5. Theft

Section E of Table 5 presents estimates of equation (1) in which the dependent variable is the propensity to commit theft. Adolescent males 14 years of age were more likely to steal in comparison to those in the omitted category (ages 11–13), and adolescents ages 15 through 17 were more likely to steal in comparison to those who were 14 years of age. Having no religious beliefs increases the propensity to steal by 3.2 percentage points. If the family received welfare payments, the probability of engaging in theft was almost 4 percentage points higher. There is no evidence that economic conditions or deterrence influence the probability of stealing.

4.6. The Issue of Endogeneity and Tests for Sensitivity

Arguably, the most difficult empirical challenge facing researchers in this area is to account for the potential endogeneity of many deterrence measures. We took a number of steps to help minimize this problem. First, we used the overall (as opposed to the juvenile) arrest rate as our primary measure of deterrence. This step should have had the effect of reducing the potential for reverse causality. In addition, following Corman and Mocan (2000, 2005), Mocan and Gittings (2003), and Levitt (1998) the arrest rate was lagged. Past values of arrests are expected to impact the current crime commission, whereas the level of current criminal activity cannot influence past arrests. Finally, we included a measure of criminal activity in the county of residence. Levitt (1998) argued that unobservable factors potentially correlated with juvenile behavior and deterrence can be controlled for in this manner.

To investigate the sensitivity of our results, we experimented with several alternative specifications. First, we reestimated our models using per capita police spending and arrests per property crimes in addition to the arrest rate for violent crimes. The coefficients of these variables were not significantly different from zero, whereas other estimated coefficients remained essentially unchanged. We also dropped the religion variables, the voting variables (%Ross Perot, %Democrat), and the county crime rate variable individually, as well as jointly. Again, our results were extremely robust.

In addition, all of the models were estimated separately for females. The results revealed interesting differences between male and female juvenile

criminal behavior. Appendix Table A1 summarizes the results for females. In contrast to what we found for males, the propensity to sell drugs is lower for black female juveniles as compared to white females. Parental education has a more pronounced impact on female delinquency than was the case for males. Similarly, county characteristics such as the population density, and the racial and ethnic makeup of the county seem to be more important determinants of female than male criminal activity. There is evidence that violent crime arrests deter theft and the selling of drugs among females.

Finally, we estimated ordered probit models for both genders. As reported, the criminal activity measures in the Adolescent Health data can be broken into frequency categories: zero offenses, one to two offenses, three to four offenses, and five or more offenses. The results of these ordered probits are consistent with the participation regression results.¹²

5. Summary and Simulations

Table 6 summarizes the results reported in Table 5 for selected variables. The variables in the upper half of Table 6 can be thought of as nonpolicy variables and include race, age, and the religion of the individual. The variables in the lower half of Table 6 can be thought of being at least to some degree under the control of policy makers, and include parental education, family structure, family poverty, unemployment, per capita welfare spending in the county of residence, and the arrest rate for violent crimes.

The results summarized in Table 6 suggest that drug dealing and assault are sensitive to increases in the violent crime arrest rate. Family poverty, measured by welfare receipt, has a positive impact on juveniles' involvement in robbery, burglary, and theft. County poverty, measured by per capita welfare spending, has a positive impact on selling drugs, assault, and robbery. Lack of employment opportunities, as measured by the county unemployment rate, seems to encourage the selling of drugs and robbery.

Living in a two-parent family lowers juvenile males' probability of participation in assault and the selling of drugs. This result is consistent with some, but not all, previous studies in the area (Seydlitz and Jenkins,

12. These results, which are not reported in the interest of space, are available in Mocan and Rees (1999).

Table 6. Summary Results for Juvenile Males

Variable	Selling Drugs	Assault	Robbery	Burglary	Theft
Black	+	+	+		
Asian	–				
Native American	+	+			
Other Race				+	
Hispanic	+				
Age 14	+		+	+	+
Age 15	+		+	+	+
Age 16	+		+	+	+
Age 17	+		+		+
Born Again Christian	–	–			
Catholic		–	–		
No Religion	+			+	+
Father—High School Grad.		+			
Father—Some College		+			
Mother—High School Grad.					+
Mother—Some College	+				
Father—Education Missing		+	+	+	+
Mother—Education Missing	+			+	+
Two-Parent Family	–	–			
Parent on Welfare			+	+	+
County Unemployment	+		+		
Per Capita Welfare Spending	+	+	+		
Arrests Per Violent Crime	–	–			

Note: + indicates a positive and significant estimated coefficient at the 10% level using a two-sided test, and – indicates a negative and significant coefficient at the 10% level using a two-tailed test.

1998, p. 62), and is perhaps attributable to parental supervision. Our results can also be seen as providing support for the social interaction hypothesis.¹³

It is not clear why race is a determinant of criminal activity after controlling for personal, family and county-level factors. It is possible that race is capturing some effect not measured by the other variables in the model. For example, although all of the individuals in our sample are enrolled in high school, it is possible that school quality is correlated with race.

It is natural to ask how consistent our results are with recent time trends in juvenile crime. Time-series data on juvenile crime are not available, but

13. Glaeser, Sacerdote, and Scheinkman (1996) explore the influence of social interactions on crime. They find higher levels of social interactions in cities with more female-headed households, and suggest that social interactions among criminals are higher if the family units are not intact.

juvenile crime can be imputed by using the Uniform Crime Reports of the FBI and the NCVS (see note 7). Using the algorithm described earlier, we calculated that in 1989 there were a total of 4.7 million crimes committed by juveniles. This is the sum of robberies, assaults, burglaries, and thefts. Total juvenile crime increased to 7.8 million by 1993, an increase of 3.1 million offenses. During the same time period the arrest rates and police spending also increased. However, these increases are potentially endogenous; that is, they may have been determined by increases in the crime rate. On the other hand, there were two changes during this period that can be considered exogenous: The aggregate unemployment rate increased by 1.4 percentage points (from 5.5% to 6.9%), and the number children living in families receiving AFDC payments increased by ~ 1 million (U.S. House Committee on Ways and Means, 1998). Using these figures and the estimated parameters presented in Table 5, a back-of-the-envelope calculation indicates that the increase in unemployment and family poverty can explain ~ 14% of the increase in juvenile crime between 1989 and 1993.¹⁴

By 1996, the unemployment rate had fallen to 5.4%, and the number of children on welfare decreased by 1.1 million. The total number of juvenile crimes fell to 7.2 million by 1996. A back-of-the-envelope calculation indicates that these declines in unemployment and poverty together explain 28% of this decrease in juvenile crime.

6. Conclusion

Crime remains in the forefront of social problems facing the nation. Juvenile crime in particular has received a great deal of attention from the media and public. Despite the decline in juvenile crime since the early 1990s (Blumstein and Wallman, 2000), opinion polls indicate that the public overwhelmingly believes that juvenile crime is a serious problem facing the country (Soler, 2001). In response, law makers have adopted legislation targeted at reducing the number of illegal acts committed by young Americans. For example, between 1992 and 1997, 47 states and the District of Columbia made their juvenile justice system more punitive either by making it easier to prosecute juveniles as adults, by removing

14. This is a rough calculation. Note that our measure of family poverty does not correspond to the measure of poverty reported by the U.S. Committee on Ways and Means (1998).

confidentiality protections of juvenile court records, or by expanding sentencing authority (Snyder and Sickmund, 1999).

This article uses a nationally representative sample of 14,942 high school students surveyed in 1995 to investigate the determinants of criminal activity among juveniles. The data allow us to gauge the extent of the problem, as well as to explore the impact of economic and deterrence variables, controlling for a rich array of personal, family, and county characteristics.

According to our calculations, in 1995 ~ 7 million juveniles (one-quarter of adolescents in the 11–17 age range) claimed to have committed at least one criminal act in the previous year. One million two hundred thousand juveniles sold drugs, 3.3 million committed assault, 725,000 juveniles committed robbery, 866,000 committed burglary, and 860,000 stole something worth more than \$50. Altogether we estimate that there were a total of 16.5 million offenses committed by juveniles during the period under study.

Estimates of standard single-equation probit models provide some evidence that juveniles respond to incentives as predicted by Becker's (1968) theory of criminal behavior. An increase in the violent crime arrest rate, a measure of deterrence, reduces the probability that males sell drugs and commit assault and reduces the probability that females sell drugs and steal. An increase in the county unemployment rate increases the probability that males sell drugs and commit robbery, and increases the probability that females commit assault. This pattern of results runs counter to claims that at-risk young Americans are so present-oriented that they do not respond to incentives and sanctions.

Racial differences persist even after controlling for personal, family, and county characteristics. For example, all else equal, in comparison to whites, black male juveniles are more likely to sell drugs, commit robbery, and commit assault. It is not clear why racial differences exist after controlling for other factors. One possible explanation is that race may act as a proxy for unobservable neighborhood characteristics or school quality.

Education of the parents has a more pronounced impact on female juvenile criminal activity than that of males. This is especially true in the case of mother's education. Having a college-educated mother is associated with a lower probability that females sell drugs and commit assault, robbery, and theft. Religious beliefs seem to impact the propensity to

engage in criminal acts, as does family structure. Male juveniles who come from two-parent families are less likely to commit assault and sell drugs, whereas juvenile females from two-parent families are less likely to sell drugs, commit assault, and commit robbery. These results suggest that family supervision may play an important role in the determination of delinquent behavior.

In summary, we interpret our results as providing evidence that juveniles respond to incentives and sanctions. Providing more extensive employment opportunities and greater deterrence may reduce overall levels of juvenile crime, but this reduction, is likely to be more pronounced for certain crimes than others.

Appendix Table A1. Summary Results for Juvenile Females

Variable	Selling Drugs	Assault	Robbery	Burglary	Theft
Black	—	+	+		
Asian	—				
Native American		+	+		
Other Race		+	+		
Age 14	+			+	+
Age 15	+				+
Age 16	+	—	—		+
Age 17	+	—		—	
Born Again Christian	—		—		
Baptist				—	
No Religion		+	+		+
Father—High School Grad.		+			
Mother—No High School		+			
Mother—High School Grad.	+	+	+		+
Mother—Some College	+	+			
Father—Education Missing		+			
Mother—Education Missing	+	+	+		+
Two-Parent Family	—	—	—		
Parent on Welfare		+		+	
County Unemployment		+			
Per Capita Welfare Spending	+	+	+		+
County Population Density	—		—	—	—
% County Rural	—		—	—	—
% County Pop. Hispanic	—		—		—
% Ross Perot				+	
% Democrat	+				
Arrests per Violent Crime	—				—

Note: + indicates a positive and significant estimated coefficient at the 10% level using a two-tailed test, and — indicates a negative and significant coefficient at the 10% level using a two-tailed test

References

- Baron, Stephen W. and Timothy F. Hartnagel. 1997. "Attributions, Affect, and Crime: Street Youths' Reaction to Unemployment." 35(3) *Criminology* 409–34.
- Becker, Gary. 1968. "Crime and Punishment: An Economic Approach." 76(2) *Journal of Political Economy* 169–217.
- Block, Michael K., and John M. Heineke. 1975. "A Labor Theoretic Analysis of the Criminal Choice." 65(3) *American Economic Review* 314–25.
- Blumstein, Alfred, and Joel Wallman, 2000. *The Crime Drop in America*. Cambridge: Cambridge University Press.
- Bound, John, and Richard B. Freeman. 1992. "What Went Wrong? The Erosion of Relative Earnings and Employment among Young Black Men in the 1980s." 107(1) *Quarterly Journal of Economics* 201–32.
- Corman, Hope, and H. Naci Mocan. 2000. "A Time-Series Analysis of Crime, Deterrence and Drug Abuse in New York City." 90(3) *American Economic Review* 584–604.
- . 2005. "Carrots, Sticks and Broken Windows." 48(1) *Journal of Law and Economics* 235–66.
- Cornwell, Christopher and William N. Trumbull. 1994. "Estimating the Economic Model of Crime With Panel Data." 76(2) *Review of Economics and Statistics* 360–66.
- DiIulio, John J. Jr. 1996. "Help Wanted: Economists, Crime and Public Policy." 10(1) *Journal of Economic Perspectives* 3–24.
- Ehrlich, Isaac. 1973. "Participation in Legitimate Activities: A Theoretical and Empirical Investigation." 81(3) *Journal of Political Economy* 521–65.
- Elliott and Voss. 1974. *Delinquency and Dropout*. Lexington, MA: DC Heath.
- Freeman, Richard B. 1983. "Crime and Unemployment." In J. Q. Wilson, ed., *Crime and Public Policy*. San Francisco: ISC Press, 89–106.
- . 1986. "Who Escapes? The Relation of Churchgoing and Other Background Factors to the Socioeconomic Performance of Black Male Youths from Inner City Tracts." In Richard B. Freeman and Harry J. Holzer, eds., *The Black Youth Employment Crisis*. Chicago: University of Chicago Press, 353–76.
- Freeman, Richard B., and William M. Rodgers III. 2000. "Area Economic Conditions and the Labor Market Outcomes of Young Men in the 1990s Expansion." In Robert Cherry and William M. Rodgers, eds., *Prosperity for All? The Economic Boom and African Americans*. New York: Russell Sage Foundation.
- Gallup Organization. 1999. "Gallup Poll of Social and Economic Indicators." Princeton, NJ: Gallup Organization.
- Glaeser, Edward L., Bruce Sacerdote, and Jose A. Scheinkman. 1996. "Crime and Social Interactions." 111(2) *Quarterly Journal of Economics* 507–48.
- Gottfredson, Michael R., and Travis Hirschi. 1990. *A General Theory of Crime*. Stanford, CA: Stanford University Press.

- Gould, Eric D., David B. Mustard, and Bruce A. Weinberg. 2002. "Crime Rates and Local Labor Market Opportunities in the United States: 1977–1997." 84(1) *Review of Economics and Statistics*.
- Grogger, Jeff. 1998. "Market Wages and Youth Crime." 16(4) *Journal of Labor Economics* 756–91.
- Hagan, John, John H. Simpson, and A. R. Gillis. 1979. "The Sexual Stratification of Social Control: A Gender-Based Perspective on Crime and Delinquency." 30(1) *British Journal of Sociology* 25–38.
- Harlow, Caroline W. 2003. *Education and Correctional Populations*. U.S. Department of Justice, Bureau of Justice Statistics, Washington DC.
- Hashimoto, Masanori, 1987. "The Minimum Wage Law and Youth Crimes: Time-Series Evidence." 30 *Journal of Law and Economics* 443–64.
- Henggeler, Scott W. 1989. *Delinquency in Adolescence*. Newbury Park, CA: Sage.
- Hindelang, Michael J., Travis Hirschi, and Joseph G. Weis. 1981. *Measuring Delinquency*. Beverly Hills, CA: Sage Publications.
- Horowitz, Allan V., and Helene Raskin White. 1987. "Gender Role Orientations and Styles of Pathology Among Adolescents." 28 *Journal of Health and Social Behavior* 158–70.
- Jarjoura, Roger G. 1993. "Does Dropping out of School Enhance Delinquent Involvement? Results from a Large-Scale National Probability Sample." 31(2) *Criminology* 149–72.
- Kapuscinski, Cezary A., John Braithwaite, and Bruce Chapman. 1998. "Unemployment and Crime: Toward Resolving the Paradox." 14(3) *Journal of Quantitative Criminology* 215–43.
- LaGrange, Teresa C., and Robert A. Silverman. 1999. "Low Self-Control and Opportunity: Testing the General theory of Crime as an Explanation for Gender Difference in Delinquency." 37(1) *Criminology* 41–69.
- Lau, Morten I., and Melonie B. Williams. 1998. "Gender-Specific Discount Rates: Evidence from the Experimental Laboratory." Paper presented at the 1999 meeting of the American Economic Association.
- Levitt, Steven D. 1998. "Juvenile Crime and Punishment." 106(6) *Journal of Political Economy* 1156–85.
- . 2002. "Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime: A Reply." 92 *American Economic Review* 1244–50.
- Levitt, Steven D., and Lance Lochner. 2001. "The Determinants of Juvenile Crime." In Jonathan Gruber, ed., *Risky Behavior among Youths*. Chicago: University of Chicago Press, 327–74.
- Los Angeles Times*. 1999. "Heading Off Youth Crime." April 27.
- Mocan, H. Naci, and R. Kaj Gittings. 2003. "Getting off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment." 46(2) *Journal of Law and Economics* 453–78.

- Mocan, H. Naci, and Daniel I. Rees, 1999. "Economic Conditions, Deterrence and Juvenile Crime: Evidence from Micro Data." NBER Working Paper No. 7405, Cambridge, MA.
- Mocan, H. Naci, Steven C. Billups, and Jody Overland. Forthcoming "A Dynamic Model of Differential Human Capital and criminal Activity." *Economica*.
- New York Times*. 2001. "Violence Is Down, but Some Areas Still Suffer." January 11.
- . 2002. "City Is Urged Not to Add Jail Space for Juveniles." April 5.
- Ploeger, Matthew. 1997. "Youth Employment and Delinquency: Reconsidering a Problematic Relationship." 35(4) *Criminology* 659–75.
- Powell, Melanie, and David Ansic. 1997. "Gender Differences in Risk Behaviour in Financial Decision Making: An Experimental Analysis." 18(6) *Journal of Economic Psychology* 605–27.
- Sah, Raaj K. 1991. "Social Osmosis and Patterns of Crime." 99(6) *Journal of Political Economy* 1272–95.
- Schneider, Sandra L., and Lola L. Lopes. 1986. "Reflection in Preferences under Risk: Who and When May Suggest Why." 12(4) *Journal of Experimental Psychology; Human Perception and Performance* 535–48.
- Seydlitz, Ruth, and Pamela Jenkins. 1998. "The Influence of Families, Friends, Schools, and Community on Delinquent Behavior." In Thomas P. Gullotta, Gerald R. Adams, and Raymond Montemayor, eds., *Delinquent Violent Youth: Theory and Interventions*. Thousand Oaks, CA: Sage Publications, 53–97.
- Smith, Carolyn, and Terence P. Thornberry. 1995. "The Relationship between Childhood Maltreatment and Adolescent Involvement in Delinquency." 33(4) *Criminology* 451–79.
- Snyder, Howard N., and Melissa Sickmund, 1999. *Juvenile Offenders and Victims: 1999 National Report*. Washington DC: Office of Juvenile Justice and Delinquency Prevention.
- Soler, Mark. 2001. *Public Opinion on Youth, Crime and Race: A Guide for Advocates*. Building Blocks for Youth.
- Tauchen, Helen, Ann Dryden Witte, and Harriet Griesinger, 1994. "Criminal Deterrence: Revisiting the Issue with a Birth Cohort," 76:3 *Review of Economics and Statistics* 399–412.
- U.S. House Committee on Ways and Means. 1998. "1998 Green Book: Background Material and Data on Programs within the Jurisdiction on Ways and Means." Committee Print. WMCP:105–7.
- Viscusi, W. Kip. 1986. "Market Incentives for Criminal Behavior." In Richard B. Freeman and Harry J. Holzer, eds., *The Black Youth Employment Crisis*. Chicago: University of Chicago Press, 301–46.
- Washington Post*. 1999. "The Missing Voice in the Debate on Youth Crime." May 23.
- Witte, Ann Dryden. 1980. "Estimating the Economic Model for Crime with Individual Data." 94(1) *Quarterly Journal of Economics* 57–84.

- Wright, B. R. Entner, Avshalom Caspi, Terrie E. Moffitt, Richard A. Miech, and Phil A. Silva. 1999. "Reconsidering the Relationship between SES and Delinquency: Causation but Not Correlation." 37(1) *Criminology* 175–94.
- Wright, John Paul, and Francis T. Cullen. 2001. "Parental Efficacy and Delinquent Behavior: Do Control and Support Matter?" 39:3 *Criminology* 677–705.
- Wright, John Paul, Francis T. Cullen, and Nicholas Williams. 1997. "Working while in School and Delinquent Involvement: Implications for Social Policy." 43(2) *Crime and Delinquency* 203–21.