NBER WORKING PAPER SERIES

THE CRIME RATE AND THE CONDITION OF THE LABOR MARKET: A VECTOR AUTOREGRESSIVE MODEL

Tadashi Yamada

Working Paper No. 1782

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 1985

NBER Working Paper #1782
December 1985

The Crime Rate and the Condition of the Labor Market: A Vector Autoregressive Model

ABSTRACT

Few empirical studies of the economics of crime have doubted the deterrent effects of the legal sanctions on crime. Those studies, however, have not established a definitive understanding of the effects of labor market conditions on crime. In this paper, we examine the impact of labor market conditions, represented by either male civilian unemployment or labor force participation rates, on seven major categories of crime, using the quarterly crime-rate data for the United States.

Based on an analysis of the reported crime rates for murder, forcible rape, robbery, aggravated assault, burglary, larceny-theft, and motor vehicle theft during the period from the first quarter of 1970 through the fourth quarter of 1983, we reject the null hypothesis that labor market conditions have no effects on the crime rate. Rather, we find that the male civilian unemployment rates, especially the rate for those twenty-five years old and over, are strongly and positively associated with most of the crime rates studied. The male civilian labor force participation rates are also found to be related to the crime rates considered here. Youth labor force participation rates for both whites and non-whites, sixteen to nineteen years old, are more strongly associated with the examined crime rates than are the labor force participation rates for males, twenty years old and over.

Tadashi Yamada
NBER
269 Mercer Street, 8th Floor
New York, NY 10003

The Crime Rate and the Condition of the Labor Market
A Vector Autoregressive Model

Tadashi Yamada*

I. Introduction

Since the seminal work of Becker [3], there has been, in studies of the economics of crime, a considerable amount of theoretical and empirical analysis of the effects of legal sanctions on criminal activities (e.g., Block and Heineke [4]; Ehrlich [7] and [8]; Hoenack and Weiler [16]; Schmidt and Witte [24]). While most previous empirical studies agree on the deterrent effects of legal sanctions on crime[1], there is yet to be a definitive statement about the effects of labor market conditions on the crime rate. The statistical significance and sign of the unemployment-rate--crime-rate relation surprisingly vary from one empirical study to another. If there is an unemployment rate effect on the crime rate, the spillover effect of the unemployment rate on the crime rate is too important for the makers of public policy to ignore. Therefore, the empirical relationships between labor market conditions and the crime rate deserve more careful attention and clarification.

There are, in our opinion, two major drawbacks to previous empirical studies of the crime rate and labor market conditions. First, most of the empirical models did not allow for the lagged effects of the unemployment rate on the crime rate.[2] One can easily discover from the crime-rate data for the last decades that the crime rate has had cyclical and lagged behavior, varying over the business cycles. We will show that this lag specification

is significant. Second, it is not likely that the models are free of a strong multicollinearity between the unemployment rate and other explanatory variables, e.g., income distribution and wages. Unemployment usually affects unskilled workers, minority groups, and secondary workers, and thereby exacerbates income inequality. A given level of unemployment rate is likely to influence not only the rate of change, but also the level of wage rates in the labor market. In our view, a lag specification on the unemployment rate variable and multicollinearity between the unemployment rate and other explanatory variables in a crime supply function are primarily responsible for the inconclusive empirical results in past analyses of the unemployment-rate--crime-rate relation.

The purpose of this study is to re-examine the relationships between the unemployment rate (and, the labor force participation rate) and the crime rate by using a different methodology from that used in most previous empirical studies. We apply time series techniques developed by Granger [13] and Sims [25] to quarterly time series data on the male civilian unemployment and labor force participation rates and the rates of seven categories of crime: murder, forcible rape, robbery, aggravated assault, burglary, larceny-theft, and motor vehicle theft. An application of the time series methodology is intuitively appealing as a way of analyzing the significance and sign of the unemployment effects on these crime rates as well as the timing of changes in these crime rates in response to changes in labor market conditions.

The period of analysis for this study is from the first quarter of 1970 to the fourth quarter of 1983 in the United States. There are a number of reasons why we choose this period for study. First, during this period, there have been significant fluctuations in male civilian unemployment rates for almost all age groups, and similarly there have been significant fluctuations in male civilian labor force participation rates, especially for youths under the age of twenty. Second, the crime rates mentioned above all experienced an unprecedentedly rapid rise during this period, except for the last three years.[3] Finally, few empirical studies on the unemployment-rate--crime-rate relation have covered the period that we analyze.

The organization of the subsequent sections of this study is as follows: Section II is a brief review of the previous empirical findings on the unemployment-rate--crime-rate relation. Section III describes the time series techniques applied to observe dynamic relationships between variables in a system. Section IV reports the empirical results. Finally, Section V gives the conclusion of this study.

II. A Review of the Previous Findings

Changes in labor market conditions alter an individual's expected earning opportunities from legal market activities. Smaller opportunity costs due to unemployment would increase the incentive for an individual to commit a crime as an alternative pecuniary source and/or some form of psychic gratification. Despite the plausibility of this argument, both time series and cross-sectional analyses have found two contrasting empirical interpretations of the relationships between the unemployment rate and the crime rate.

First, time series analyses of the unemployment-rate--crime-rate relation for the United States display a wide variation in their findings. Fleisher [9] found the effect of the male civilian unemployment rate on juvenile delinquency to be positive and significant using data from Boston, Cincinnati, and Chicago combined, and from Boston alone, over the period from 1936 to 1956. In the same study, Fleisher also found a similar result for the aggregated U.S. data for the period from 1932 to 1961.[4]

Contrary to the Fleisher findings, an analysis by Danziger and Wheeler [6] of the aggregate U.S. data during the period from 1947 to 1970 showed no significant unemployment rate effects on property crimes such as robbery[5] and burglary except its significantly negative impact on assault. Similarly, Land and Felson [17] rejected unemployment rate effects on property and violent crimes for the sample period from 1947 to 1972.

Supporting a view that murder is often a by-product of crimes involving material gain, Ehrlich [8], using the U.S. annual data for the period between 1933 and 1969, reported a significantly positive unemployment rate effect on murder. However, by re-examining a sample period similar to Ehrlich's, Hoenack and Weiler [16] reported that neither unemployment nor labor force participation rates have statistically significant effects on murder rates and consequently rejected the Ehrlich findings.

Since a labor-force-participation-rate--crime-rate relation appears, in general, statistically stronger than an unemployment-rate--crime-rate relation in time series studies, Freeman [11] claims that "... those who leave the labor force are the most crime prone (p. 10)." This view is strongly supported by the evidence that labor market opportunities measured by labor force participation rates are the major factor for explaining the increasing property crime rates for youths for the period from 1953 to 1967 in the United States (Phillips, et al. [21]). Also, Ehrlich [7] indicates that the labor force participation rate could represent an index of the total time spent in legitimate market activities.

Second, cross-sectional analyses of the unemployment-rate--crime-rate relation are inconclusive on the unemployment rate effect. Fleisher [10] found the male civilian unemployment rate to be a cause of juvenile delinquent behavior in the seventy-four census-tract communities in the city of Chicago and in the forty-five suburbs of Chicago in Cook County, for the years between 1958 and 1961 (Also, see Allison [1], who made a similar

finding using 1960 data from Chicago and its surrounding communities.) However, Weicher [29] indicated that the Fleisher results depended heavily on the choice of the variables which represent tastes for jouvenile delinquency in the Fleisher regressions. In fact, in Weicher's regressions, the male civilian unemployment rates are statistically insignificant and sometimes even statistically negative.

In Ehrlich's analysis of property and violent crime rates for 1960 across the United States, the variable of the unemployment rate of civilian urban males, ages fourteen to twenty-four, has virtually no effect on the crime rate (Ehrlich [7]). The study found statistically significant labor-force-participation-rate--crime-rate relation: positive effects on the larceny and auto theft rates and negative effects on the murder and rape rates.[6]

Ehrlich [7] gives two reasons why the unemployment rate variable is not significant at all. First, the unemployment rate among the age group from fourteen to twenty-four is predominantly voluntary unemployment due to the search for desirable employment. Second, the variables for the unemployment rate and income inequality (measured by the percentage of families below one-half of median income) are highly correlated with each other in the regressions since an increase in unemployment rates is likely to aggravate income inequality by disproportionately affecting those people with lower schooling and job experiences.

Using data from fifty-three municipalities with 1960 populations ranging from 25,000 to 200,000, Sjoquist [26] found a

significantly positive effect of the unemployment rate on property crime rates (combining robbery, burglary, and larceny rates) in 1968. Sjoquist assumes that an unemployed person has less income than a normally employed person and would have more incentive to commit crimes than an employed one because the former has more time to allocate to illegitimate activities. Hoch [15] and Bechdolt [2] support the Sjoquist finding: Hoch uses 1960 and 1970 combined data from Standard Metropolitan Statistical Areas (hereafter, SMSAs) while Bechdolt studies data drawn from Los Angeles census tracts for 1960 and from Chicago police districts for 1970. Although these three studies strongly support the unemployment-rate--crime-rate relation, it is worth noting that other analyses of SMSAs negate these relationships (e.g., see Danziger and Wheeler [6]; Pogue [23]).

Finally, with respect to analyses that use individual data, which have the great advantage of focusing on individual choices between legitimate and illegitimate activities, we also find two conflicting results. Witte [30] found extremely weak relationships between labor market conditions and the crime rate by examining the post-release activities of a random sample of 641 men who were in prison in North Carolina in 1969 or 1971. On the contrary, Myers [20] found the opposite result, based on a sample of 432 males released in 1971-1972 from Maryland's state prisons to the Baltimore area.

We notice that, so far, the empirical results of these studies of the unemployment-rate--crime-rate relation are still ambiguous

and highly sensitive to the specification of a crime supply function. To clarify this ambiguity and overcome this sensitivity, we will propose a quasi-reduced form of a crime model in the following section.[7]

III. Statistical Model

In this section, we illustrate the statistical methodology used in our analysis of the unemployment (and, labor force participation)-rate--crime-rate relation.

Assume a particular crime rate observed at time t, Y(t), has two components:

$$Y(t) = Y_n(t) + Y_c(t), \quad \ldots\ldots \quad (1)$$

where Y_n and Y_c represent normal and cyclical components, respectively. The normal component Y_n would be explained in a structural model, which includes a crime supply function, the production functions of the probabilities of arrest, of conviction, and of punishment, and public expenditure functions (e.g., Greenwood and Wadycki [14]; Hoenack and Weiler [16]). Here we assume that the lagged crime rate in question, Y, another related, lagged crime rate, Y*, and trend T capture the normal component Y_n, while the lagged unemployment rate U represents the cyclical component Y_c.

In a vector autoregressive model, we will have a vector autoregressive representation (hereafter, VAR) as follows:

$$Y(t) = A(L)Y(t) + B(L)Y^*(t) + C(L)U(t) + hT + e(t), \quad \ldots\ldots \quad (2)$$

and

$$U(t) = D(L)Y(t) + F(L)Y^*(t) + G(L)U(t) + h'T + e'(t), \quad \ldots\ldots \quad (3)$$

where $A(\cdot)$, $B(\cdot)$, $C(\cdot)$, $D(\cdot)$, $F(\cdot)$, and $G(\cdot)$ are distributed lag coefficients; L is a lag operator, defining $L^1Y(t) = Y(t-1)$; and

h and h' are the coefficients on trend T, reflecting individual's allegiance to societal norms. e and e' in the VAR are random variables, i.e., residuals, which are called the innovations in crime rate Y and unemployment rate U, respectively, in the VAR analysis. The innovations, e and e', are assumed white noise with no contemporaneous, as well as lagged, correlation with each other.

An estimation of equation (3) simultaneously with equation (2) in the VAR, will make it statistically possible to simulate future responses in the crime rate in question, Y, to random shocks in the innovation in unemployment rate, U. In a theoretical sense, a rationale for equation (3) can be found in Witte [30]: "... low quality jobs are readily available to ex-offenders, but higher quality jobs are more difficult to encounter... [the unemployment rate] becomes a variable endogenous to the system and simultaneous equations methods should be used to estimate the model (p. 80)."[8]

To test whether the current crime rate in question, Y(t), can be predicted by the past unemployment rates, the null hypothesis is set that C(·) in equation (2) should be zero if there is no Granger-causality from the unemployment rate to the crime rate.[9] Since the estimated distributed lag coefficients for C(·) include complicated cross-equation feedbacks, the sum of the estimated C(·) does not yield a total impact of the unemployment rate on the crime rate. Sims [25] suggests estimating a moving average representation (hereafter, MAR) instead, in order to observe responses in the crime rate to the unemployment rate.

A particular i-th equation, e.g., a murder equation, in the

MAR inverted from the aforementioned VAR is shown as:

$$\text{Murder}(t) = \sum_{j=1}^{q} \sum_{s=0}^{k} m_j(s)\ e_j(t-s), \quad \ldots\ldots \quad (4)$$

where "q" is the number of the variables in the system. In equation (4), the sum of $m_j(s)$ from s=0 to s=k, e.g., the j-th component of e ≡ the innovation in male civilian unemployment rate for those sixteen to seventeen years old (U1617), represents the cumulative responses of the murder rate in the k+1 step-ahead to random shocks in the innovation in U1617. The cumulative responses yield the total impact of the unemployment rate on the murder rate.[10]

IV. Empirical Results

The variables in this study are quarterly data for the United States. The behavior of seven different crime rates is analyzed over the period from the first quarter of 1970 through the fourth quarter of 1983: murder (MURD), forcible rape (RAPE), robbery (ROBB), aggravated assault (ASSA), burglary (BURG), larceny-theft (LARC), and motor vehicle theft (AUTO).[11]

The unemployment rate variable assumes male civilian unemployment rates for those sixteen to seventeen years old (U1617), eithteen to nineteen years old (U1819), twenty to twenty-four years old (U2024), and twenty-five years old and over (U25). On the other hand, in an analysis of the labor-force-participation-rate--crime-rate relation, the labor force participation rate variable assumes male civilian labor force participation rates for whites, sixteen to nineteen years old (WL1619) and twenty years old and over (WL20), and for non-whites, sixteen to nineteen years old (NWL1619) and twenty years old and over (NWL20).[12]

The system in a vector autoregressive model consists of four unemployment (or labor force participation) rates, and two crime rates, variables, all of which are expressed in logarithms. The lag length in the variables is assumed to be the same, i.e., four lag distributions, based on our preliminary work. A particular crime rate equation in the VAR includes a constant, time trend, three seasonal dummies, four own lags, four lags of another related crime rate, and four lags each of U1617, U1819, U2024, and U25 (or WL1619, WL20, NWL1619, and NWL20).[13] We,

therefore, estimate twenty-nine regression coefficients in one equation in a system consisting of six equations.

Given the four lag distributions for each of the male civilian unemployment rate variables, we performed the Granger-causality tests to examine if the unemployment rate variables have the explanatory power to predict the behavior of the crime rate dependent variable. Table 1-1 presents the F-statistics on the unemployment rate variables: U25, U2024, U1819, and U1617. The results indicate that the effect of the male civilian unemployment rate for those twenty-five years old and over (U25) is pronounced and is statistically significant in explaining the behavior of all the crime rates except the larceny-theft rate (LARC).

[Table 1-1]

The robust relationships between U25 and the various crime rates would indicate that high unemployment rates among this age group are largely due to involuntary unemployment, which causes the individual male or his family to feel insecure and reduces the acquisition of market goods and services with legitimate family earnings. These circumstances would increase the incentive to commit crimes.

The results for the male civilian unemployment rates among youths, e.g., among those sixteen to seventeen years old (U1617) and those eighteen to nineteen years old (U1819), are relatively disappointing. The weak association between the unemployment rate among youths and the crime rate, however, conforms with previous findings, supporting the view that the unemployment rate among

teenager groups is predominantly voluntary unemployment due to the search for desired employment.

Table 1-2 reports the cumulative responses of the various crime rates four, eight, and twelve quarters ahead to a one standard deviation shock in the innovation in U25. That is, the cumulative responses show the total impacts from the unemployment rate on the crime rate for the different quarters ahead. We find that the impact of U25 on all crime rates is unambiguously positive at all time horizons shown except for the eight and twelve quarters ahead for the motor vehicle theft rate (AUTO). The predominantly positive association strongly supports the position that an increase in the unemployment rate among the prime-age males (twenty-five years old and over) will necessarily raise the overall crime rate in the society.

[Table 1-2]

In terms of "marginal" responses in the crime rate from quarter to quarter in Table 1-2, we note that the marginal cumulative responses in most of the crime rates reach their maximums within four or eight quarters ahead. For example, the marginal responses in the murder rate (MURD) are 1.06 for the first four quarters ahead and 0.16 (=1.22-1.06) for the second four quarters ahead. In other words, an increase in MURD due to a rise in U25 is mostly realized within the first four quarters ahead, i.e., one year. We can find similar results for all other crime rates except the larceny-theft rate (LARC).

In interpreting the numerical results of the cumulative responses in Table 1-2, when U25 is about 0.5 percent (this value is not reported but is obtained from the estimated matrix of the moving average coefficients) higher than forecast on the basis of past data, the effect on MURD four quarters ahead is an increase of 1.06 percent, 1.22 percent increase eight quarters ahead, and 1.20 percent increase twelve quarters ahead. The other numerical values of each crime rate for the corresponding quarters ahead can be read in a similar manner, but those values are associated with an increase of 0.4 percent of U25.[14]

Although not reported in the tables, the results of the decomposition of variance of each crime rate, due to a one standard deviation shock in the innovation in U25, also confirm the importance of U25 in explaining the behavior of the crime rates. The innovation in U25 accounts for roughly 20 to 30 percent of the variance of each crime rate four or eight quarters ahead and the proportions accounted for decay thereafter.[15]

Table 2-1 lists the F-statistics on the male civilian labor force participation rate variables--WL20, NWL20, WL1619, and NWL1619--based on the Granger-causality tests. We note the importance of the labor force participation rate of whites, sixteen to nineteen years old (WL1619), and that of non-whites, sixteen to nineteen years old (NWL1619), in predicting the behavior of the various crime rates. It is quite noteworthy that NWL1619 Granger-causes most of the crime rates: MURD, ROBB, ASSA, BURG, and AUTO. These statistically prominent associations between

the youth labor force participation rates and the various crime rates suggest that youth labor force participation rates reflecting labor market opportunities are the major indices for measuring the total time that youths have available for illegitimate activities.

[Tables 2-1 and 2-2]

Table 2-2 reports the cumulative responses in the rates of the seven categories of crime to a one standard deviation shock in the innovation in NWL1619. The responses in the crime rates are predominantly negative for the various quarters ahead considered. That is, a fall in the labor force participation rate of non-whites, sixteen to nineteen years old (NWL1619), triggers all the crime rates to rise various quarters ahead. Our findings, therefore, strongly support Freeman's claim that youths who leave the labor market are the most crime prone (Freeman [11]).

V. Conclusion

In this paper, we have examined the impact of labor market conditions on crime in a vector autoregressive model. In the analysis of the rates of seven different crimes--murder, forcible rape, robbery, aggravated assault, burglary, larceny-theft, and motor vehicle theft--over the period from the first quarter of 1970 through the fourth quarter of 1983, we rejected the null hypothesis that labor market conditions have no effects on crime rates.

The male civilian unemployment rates, especially the rate for those twenty-five years old and over, are strongly associated with most of the crime rates studied. An increase in the unemployment rate of those twenty-five years old and over clearly triggers a subsequent increase in all the crime rates, whose peaks are reached within a few years. The definite spillover effects of the unemployment rate on the various crime rates suggest that a carefully designed implementation of general macroeconomic policies aimed at reducing unemployment rates would contribute to reducing crime rates. This, however, does not imply that legal sanctions on crime might not be more effective.

The male civilian labor force participation rates are also found to be related to the crime rates considered here. Youth labor force participation rates for both whites and non-whites, sixteen to nineteen years old, are more strongly associated with the examined crime rates than are the labor force participation rates for males, twenty years old and over. The complexity of

our industrial society requires youths more to obatin formal education and more specialized training for jobs. The predominantly negative impact of the youth labor force participation rates on the crime rates suggests that publically subsidized vocational programs for youth dropouts from both school and the labor market help keep their time occupied, and that alone will consequently reduce the juvenile crime rate. Also, a subminimum wage (one below the statutory minimum wage) and a new job tax credit may have significant crime reducing effects. Expanding job opportunities for youths should be considered as equally important as the deterrent effects of the legal sanctions on crime in order to reduce the overall crime rate in the society.

Notes

* I am indebted to Michael Grossman, Bernard Okun, Paul Goldberg, and Tetsuji Yamada for their helpful comments on the first draft of this paper. The opinions expressed in this paper, as well as any errors, are mine.

1. Some of the deterrent effects are due to changes in the probabilities of arrest, of conviction, and of punishment, and also to changes in the severity of punishment.

2. The cross-sectional analyses are assumed to be based on a sample in long run equilibrium and consequently provide no information on the unemployment rate's lagged effects on the crime rate.

3. From 1980 to 1983, the notable rate reductions were among murder (a 19 percent reduction), robbery (a 14 percent reduction), burglary (a 21 percent reduction), and motor vehicle theft (a 14 percent reduction), based on the annual crime rates per 100,000 inhabitants (United States [28]).

4. Concerning an unemployment-rate--crime-rate relation in foreign countries, Wolpin [31; 32] found significantly positive unemployment rate effects on robbery rates for England and Wales over the period 1894-1967 and also for England and Japan from 1955 to 1971.

5. According to recent Uniform Crime Reports (United States [28]), published by the Federal Bureau of Investigation, "violent crime" includes murder, forcible rape, robbery, and aggravated assault, while "property crime" includes burglary, larceny-theft, and motor vehicle theft. Since robbery used to be classified as one of the property crime, I have followed the classification in

the articles which were reviewed.

6. The positive labor force participation rate effect on the rate of crimes against property and its negative effect on the rate of crimes against persons are considered to be due to the scale effect of the participation in criminal activities since the labor force participation rate is viewed as an index of the total time spent in legitimate activities (Ehrlich [7], p. 555).

7. Recent studies by Corman, et al. [5], McPhetters, et al. [19], and Phillips and Ray [22], which used dynamic models of crime, are noteworthy. Corman, et al., and Phillips and Ray found dynamic unemployment rate effects on the crime rates, while McPhetters, et al., who did not incorporate the unemployment rate in their model, reported that changes in criminal sanctions altered the structural mixed autoregressive-integrated-moving average (ARIMA) model of the robbery rate.

8. An abbreviation is used in the text.

9. Granger [13] defines causality between two stationary stochastic time series, X(t) and Y(t), within a set of information in the universe as follows: A time series X causes another time series Y if the current value of Y is more accurately predicted by using the information that includes at least the own-past series of Y and the past series of X, than by using the information that excludes the past series of X.

10. If the innovations in variables are contemporaneously correlated with each other, it is not possible to partition the variance of the crime rate, e.g., murder rate, into pieces

accounted for by each innovation. An orthogonalization for the innovations in the variables in the MAR is, therefore, made after a triangularization of the system. See Gordon and King [12], Litterman [18], and Sims [25] for details.

11. These data are relative crime rates obtained from the Uniform Crime Reports for the United States (United States [28]). The four observations for each of the seven crime rates in 1969 are estimated by using the corresponding data from 1970 to 1980.

12. The data are obtained from United States [27].

13. The adapted lag distribution is not entirely arbitrary since the additional lag distribution can be tested. In fact, our preliminary work shows no significant improvement in the F-statistics on the additional lag distributions for more than four lags.

14. The estimated cumulative responses are one-tenth smaller than those values reported in Tables 1-2 and 2-2. As long as the interpretation is made in terms of percentages, there is no qualitative change. See Litterman [18] for the interpretation.

15. The decomposition of variance in the crime rate measures the degree of interaction between the crime rate and the unemployment rate. A formula of the decomposition of variance can be found in Litterman [18], p. 79.

References

1. Allison, John P., "Economic Factors and the Rate of Crime," Land Economics, Vol. 48, No. 2 (May 1972), pp. 193-96

2. Bechdolt, Burley V. Jr., "Cross-sectional Analyses of Socio-economic Determinants of Urban Crime," Review of Social Economy, Vol. 33, No. 2 (October 1975), pp. 132-40.

3. Becker, Gary S., "Crime and Punishment: An Economic Approach," Journal of Political Economy, Vol. 76, No. 2 (March/April 1968), pp. 169-217.

4. Block, M. K., and J. M. Heineke, "A Labor Theoretic Analysis of the Criminal Choice," American Economic Review, Vol. 65, No. 3 (June 1975), pp. 314-25.

5. Corman, Hope, Theodore Joyce, and Norman Lovitch, "Crime and the Business Cycle in New York City: A VAR Approach," paper presented at the 60th Annual Conference of the Western Economic Association in Anaheim, California, June 30-July 4, 1985.

6. Danziger, Sheldon, and David Wheeler, "The Economics of Crime: Punishment or Income Redistribution," Review of Social Economy, Vol. 33, No. 2 (October 1975), pp. 113-31.

7. Ehrlich, Isaac, "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," Journal of Political Economy, Vol. 81, No. 3 (May/June 1973), pp. 521-65.

8. _____, "The Deterrent Effect of Capital Punishment: A Question of Life and Death," American Economic Review, Vol. 65, No. 3 (June 1975), pp. 397-417.

9. Fleisher, Belton M., "The Effect of Unemployment on Juvenile Delinquency," Journal of Political Economy, Vol. 71, No. 6 (December 1963), pp. 543-55.

10. _____, "The Effect of Income on Delinquency," American Economic Review, Vol. 56, No. 1 (March 1966), pp. 118-37.

11. Freeman, Richard B., "Crime and the Labor Market," National Bureau of Economic Research Working Paper No. 1031, November 1982.

12. Gordon, Robert J., and Stephen R. King, "The Output Cost of Disinflation in Traditional and Vector Autoregressive Models," Brookings Papers on Economic Activity, No. 1 (1982), pp. 205-42.

13. Granger, C. W. J., "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods," Econometrica, Vol. 37, No. 3 (July 1969), pp. 424-38.

14. Greenwood, Michael J., and Walter J. Wadycki, "Crime Rates and Public Expenditures for Police Protection: Their Interaction," Review of Social Economy, Vol. 31, No. 2 (October 1973), pp. 138-51.

15. Hoch, Irving, "Factors in Urban Crime," Journal of Urban Economics, Vol. 1, No. 2 (April 1974), pp. 184-229.

16. Hoenack, Stephen A., and William C. Weiler, "A Structural Model of Murder Behavior and the Criminal Justice System," American Economic Review, Vol. 70, No. 3 (June 1980), pp. 327-41.

17. Land, Kenneth C., and Marcus Felson, "A General Framework for Building Dynamic Macro Social Indicator Models: Including an Analysis of Changes in Crime Rates and Police Expenditures," American Journal of Sociology, Vol. 82, No. 3 (November 1976), pp. 565-604.

18. Litterman, Robert B., "Techniques of Forecasting Using Vector Autoregressions," Working Paper No. 115, Federal Reserve Bank of Minneapolis, November 1979.

19. McPhetters, Lee R., Robert Mann, and Don Schlagenhauf, "Economic Response to a Crime Deterrence Program: Mandatory Sentencing for Robbery with a Firearm," Economic Inquiry, Vol. 22, No. 4 (October 1984), pp. 550-70.

20. Myers, Samuel L., Jr., "Estimating the Economic Model of Crime: Employment Versus Punishment Effects," Quarterly Journal of Economics, Vol. 98, No. 1 (February 1983), pp. 157-66.

21. Phillips, Llad, Harold L. Votey, Jr., and Darold Maxwell, "Crime, Youth, and the Labor Market," Journal of Political Economy, Vol. 80, No. 3, Part I (May/June 1972), pp. 491-504.

22. _____, and Subhash C. Ray, "Evidence on the Identification and Causality Dispute About the Death Penalty," in Applied Time-Series Analysis, edited by O. P. Anderson and M. R. Perryman. New York: North Holland, 1982, pp. 313-40.

23. Pogue, Thomas F., "Effect of Police Expenditures on Crime Rates: Some Evidence," Public Finance Quarterly, Vol. 3, No. 1 (January 1975), pp. 14-44.

24. Schmidt, Peter, and Ann D. Witte. An Economic Analysis of Crime and Justice. Orlando: Academic Press, Inc, 1984.

25. Sims, Christopher A., "Macroeconomics and Reality," Econometrica, Vol. 48, No. 1 (January 1980), pp. 1-48.

26. Sjoquist, David Lawrence, "Property Crime and Economic Behavior: Some Empirical Results," American Economic Review, Vol. 63, No. 3 (June 1973), pp. 439-46.

27. United States. Bureau of Labor Statistics, Current Population Survey (CPS), Microfiche, New York Office.

28. _____. Department of Justice, Federal Bureau of Investigation. Uniform Crime Reports for the U.S., Various issues, Washington: Government Printing Office.

29. Weicher, John C., "The Effect of Income on Delinquency: Comment," American Economic Review, Vol. 60, No. 1 (March 1970), pp. 249-56.

30. Witte, Ann Dryden, "Estimating the Economic Model of Crime with Individual Data," Quarterly Journal of Economics, Vol. 94, No. 1 (February 1980), pp. 57-84.

31. Wolpin, Kenneth I., "An Economic Analysis of Crime and Punishment in England and Wales, 1894-1967," Journal of Political Economy, Vol. 86, No. 5 (October 1978), pp. 815-40.

32. _____, "A Time Series-Cross Section Analysis of International Variation in Crime and Punishment," Review of Economics and Statistics, Vol. 62, No. 3 (August 1980), pp. 417-23.

Table 1-1

Granger-Causality Test
F-Statistics on Male Civilian Unemployment Rate[a]
1970(I) - 1983(IV)

Independent Variable	Dependent Variable MURD	RAPE	ROBB	ASSA	BURG	LARC	AUTO
U25	2.553*	2.558*	6.330***	5.653***	3.153**	.474	6.519***
U2024	1.909	.633	3.973**	2.202*	1.410	1.930	1.418
U1819	.652	.842	.647	1.179	.406	2.327*	2.833**
U1617	2.668*	1.100	.302	.655	.620	4.236***	.312

a the degrees of freedom = (4,25)
* Significant at α = 10% ** Significant at α = 5%
*** Significant at α = 1%

Table 1-2

Cumulative Responses of Crime K Quarters Ahead to an Initial One-Standard-Deviation Shock in Innovation in Male Civilian Unemployment Rate for Those 25 Years Old and Over (U25)

Quarters Ahead	Dependent Variable MURD	RAPE	ROBB	ASSA	BURG	LARC	AUTO
4	1.06	.47	.79	.31	.65	.49	.34
8	1.22	.43	.89	.26	1.02	1.23	-.04
12	1.20	.33	1.08	.14	1.08	.96	-.07

Table 2-1

Granger-Causality Test
F-Statistics on Male Civilian Labor Force Participation Rate[a]
1970(I) - 1983(IV)

Independent Variable	Dependent Variable MURD	RAPE	ROBB	ASSA	BURG	LARC	AUTO
WL20	1.688	2.545*	1.829	3.560**	.432	.723	.659
NWL20	1.445	.893	.894	1.355	1.305	.849	1.101
WL1619	3.421**	4.505***	.312	2.677*	3.182	.459	1.638
NWL1619	2.457*	1.853	3.090**	2.860**	2.967**	1.004	3.098**

a the degrees of freedom = (4,25)
* Significant at α = 10% ** Significant at α = 5%
*** Significant at α = 1%

Table 2-2

Cumulative Responses of Crime K Quarters Ahead to an Initial One-Standard-Deviation Shock in Innovation in Male Civilian Labor Force Participation Rate of Non-whites, 16 to 19 Years Old (NWL1619)

Quarters Ahead	Dependent Variable MURD	RAPE	ROBB	ASSA	BURG	LARC	AUTO
4	-.39	-.13	-.26	-.07	-.24	-.47	-.08
8	-.60	-.22	-.38	-.10	-.31	-.41	.12
12	-.71	-.18	-.43	-.04	-.15	-.02	.14