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CRIME AND THE LABOR MARKET

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ABSTRACT

Much work on crime has focussed on the effect of criminal sanctions on crime, ignoring (except as a control variable) the effect of labor market conditions on crime. This study reviews studies of time series, cross area, and individual evidence pertaining to the effect of unemployment and other labor market variables on crime and compares the "strength" of the labor market-crime and the sanctions-crime relations. It concludes that there is a labor market-crime link but that this link is not well estimated by existing studies and is weaker than the sanctions-crime link. The rise in crime in recent years does not appear to be greatly due to the performance of the labor market.

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CRIME AND THE LABOR MARKET

> "Are there people really walking around saying there is no relationship between crime and unemployment? Are we beating a dead horse here? Is there a unanimous consensus on the subject or do we have something more to prove?" (Congressman John Conyers, cited in Unemployment and Crime, Hearings before the Subcommittee on Crime of the Committee of the Judiciary House of Representatives, Ninety-fifth Congress, Serial No. 47, p. 90)

The notion that the labor market, through unemployment, is an important determinant of the crime level has a definite appeal. Someone with a full-time high-paying job is, most of us believe, less likely to engage in crime, particularly economic crime, than someone out of work. After all, isn't idle time the devil's handmaiden?

Despite the plausibilty of the claim that high unemployment causes crime, empirical analysis shows at best a moderate link between unemployment and crime. In some analyses the expected significant postive relation is found, but in others, it is not. Similarly, some studies find a significant postive relation between poverty (measured in various ways) and crime while others do not. While no one would gainsay a relationship between the labor market and crime, the strength and magnitude of the link are more subtle and difficult to determine than one might expect.

This essay examines modern research on the relation between the labor market and crime. While there have been some reviews of the literature (Gillespie, Witte and Orsogh, Witte and Long) the effect of the labor market, especially unemployment, on crime has not received the same attention as the effect of criminal sanctions on crime rates (see National Academy of Sciences Panel on Research on Deterrent and Incapacitative Effects, 1978, and Philip J. Cooke "Research in Criminal Deterrance: Laying the Groundwork for the Second Decade"). This imbalance in the current state of analysis is unfortunate, for it directs more attention to the 'stick' of deterrence than to the 'carrot' of improved employment prospects, despite the fact that the underlying behavior presumably depends on both.

The essay begins with a brief review of the economic rationale for expecting the labor market to influence crime, considers the various methods used by social scientists to study the expected relationship, and then turns to the main issue: the empirical findings of the various studies. In this review I make an effort to delineate carefully differences among types of studies in a way which will hopefully illuminate the meaning of the work and provide suggestions for additional analyses that may yield the "something more" needed for a "unanimous consensus."

What Labor Market - Crime Link Should We Expect?

As a starting point, let us consider briefly the modern analysis of the economics of crime[1], which underlies work on the effect of the labor market as well as on the effect of criminal sanctions on crime. The modern work is grounded on an individual choice model, which treats the decision to engage in crime in the same manner as a decision to engage in any other potential money-making activity. It postulates that an individual chooses to commit a crime depending on the expected benefits and costs. The benefit from crime depends on the chance of success and the money (utility) obtained; the expected cost depends on the chance of being caught (1 minus the probability of success) and convicted, the criminal sanctions and the earnings lost as a result of imprisonment and the time allotted to the criminal activity. In this framework the labor market is expected to influence crime through the cost side: workers with high paying jobs will presumably commit less crime than workers with low paying jobs or the unemployed because the higher paid face a greater opportunity cost from crime. Their time is more valuable in legitimate activities and they risk losing more income if they are incarcerated than lower wage or unemployed persons. Because crime is risky, moreover, the analysis directs attention to risk attitudes in the decision, with further behavioral consequences. Essentially the economic model treats crime like any other career or activity choice, in which persons respond positively to the benefits and negatively to the costs of choosing the activity.

Since few would disagree that people respond to incentives in rational ways, the issue in analysis is the magnitude of such responses -- whether they are important enough to show up in observed data or whether they are too small or unimportant to matter in that behavior. It is for this reason that the vast majority of studies have had an empirical orientation.

Methods of Study

Social scientists have sought to measure the impact of labor market conditions on crime using four distinct types of studies, each of which has advantages and disadvantages for pinning down the relation under study:

(1) Time series analyses in which the crime rate is compared to the level of unemployment and related labor market indicators over time. This is the most direct way to examine the effect of the business cycle on crime and thus for answering the question of what might happen to crime levels if overall job prospects improved. Time series analysis does, however, suffer from a myriad of problems, the most serious of which is the collinearity of variables (the tendency for many variables to move together over time, providing little variation from which to discern the independent effect of each). It also suffers from an interpretative problem: a time series analysis which shows that crime varies over the business cycle can be interpreted as indicating that unemployment affects the timing rather than the level of crime. A person who decides to commit a robbery, for

relations. In the case at hand, it turns out that in several studies crime is inversely related to the percentage nonwhite in an area. At face value, this implies either that blacks are less likely to be criminals or that black areas are subject to less crime that white areas -- both highly questionable conclusions in light of other data.

(3) Comparisons of individuals who commit crimes with those who do not. Analyzing the economic model of crime with data for individuals has the advantage of focusing on actual decision-makers. For charateristics of individuals that are relatively fixed (race, sex, age, education) it provides a useful tool for inferring differences in crime rates. For variables that change or are potentially controlled by the individual, however, there are serious inference problems. One could, for example, interpret the fact that criminals are more likely to be unemployed than others in two ways: as supporting the claim that unemployment led the person into crime, or as indicating that the person was unemployed because he/she planned a crime. The direction of the causal link is, in the absence of other information, impossible to determine.

(4) Social experiments, in which the government alters the labor market opportunities for criminals, as in the Baltimore Living Insurance for Ex-prisoners Project or the Transitional Aid Research Project (TARP)[2]. Conceptually, an appropriate experiment to test the unemployment - crime link is to provide jobs at specified levels of pay to part of the released prisoner population while letting the other

example, may be more likely to rob during a recession because of a lack of alternatives, but he/she might commit the crime even if unemployment were always lower than at present. The analogy here is with a woman who decides to work one quarter out of the year. When stores put on many people near Christmas, she rationally chooses to work at that season, but in the absence of such seasonal demand for labor, she would still work one quarter a year.

(2) Cross-sectional (ecological) analysis of crime rates and labor market conditions across geographic areas. Because crime rates and other factors vary widely across states or cities, providing considerable variation in data, many analysts seek to infer the causes of crime from cross-sectional data. In contrast to time series analysis, cross-section studies are more likely to reveal "permanent" responses to crime rates to unemployment than to reflect the timing of decisions and are generally free from collinearity problems. They, however, suffer from their own set of inference problems: the possibility that areas differ in both labor market and crime for reasons having to do with the unmeasured 'nature' of the area, producing spurious or hiding true relations; the possibility that migration of criminals, say from high unemployment to low unemployment areas may eliminate the link of unemployment to crime in area data, despite the fact that high unemployment conditions create more criminals; and the 'ecological correlation' problem arising from the difficulty of making inferences about individual behavior from area

TABLE 1: WHAT THE TIME SERIES STUDIES SHOW

Author, and Nature of Study	Effects of Unemployment	Effects of Labor Force Participation	Effect of Other Labor Market Variables	Comparison to Deterrence Variable
Fleisher, Analysis of Age Specific Arrest Rates in 3 Cities, 1930s - 1950s	yes	-	-	-
Phillips, Votey and Maxwell, Analysis of Age Specific Arrest Rates, 18 - 19 Year Olds, 1952 - 1967	yes	yes	-	-
Phillips, Analysis of 18 - 19 Year Olds Arrest Rates, 1964 - 1977	yes	yes	-	-
Phillips and Ray, Analysis of California Homicide Rate	yes (3 1/3 year lag)	-	-	unemployment is weaker
Brenner (1978), Analysis of Homicide, Arrest Rates and Unemployment, 1940 - 1973, 1952 - 1975	yes	-	yes, per capita income	-
Danziger and Wheeler, Analysis of Property Crime Rates, 1949 - 1970	no	-	yes, income inequality	-
Ehrlich (1975), Analysis of Murder Rate, 1933 - 1969	yes	yes	yes, median income	unemployment is weaker
Orsagh, Analysis of Crime Rate, 1950 - 1974	yes	-	-	-
Leveson, Analysis of Crime Rate and Youth Unemployment	yes	-	-	-
Land and Felson, Various Crimes 1947 - 1972	yes	-	-	unemployment is weaker

Source: see bibliography

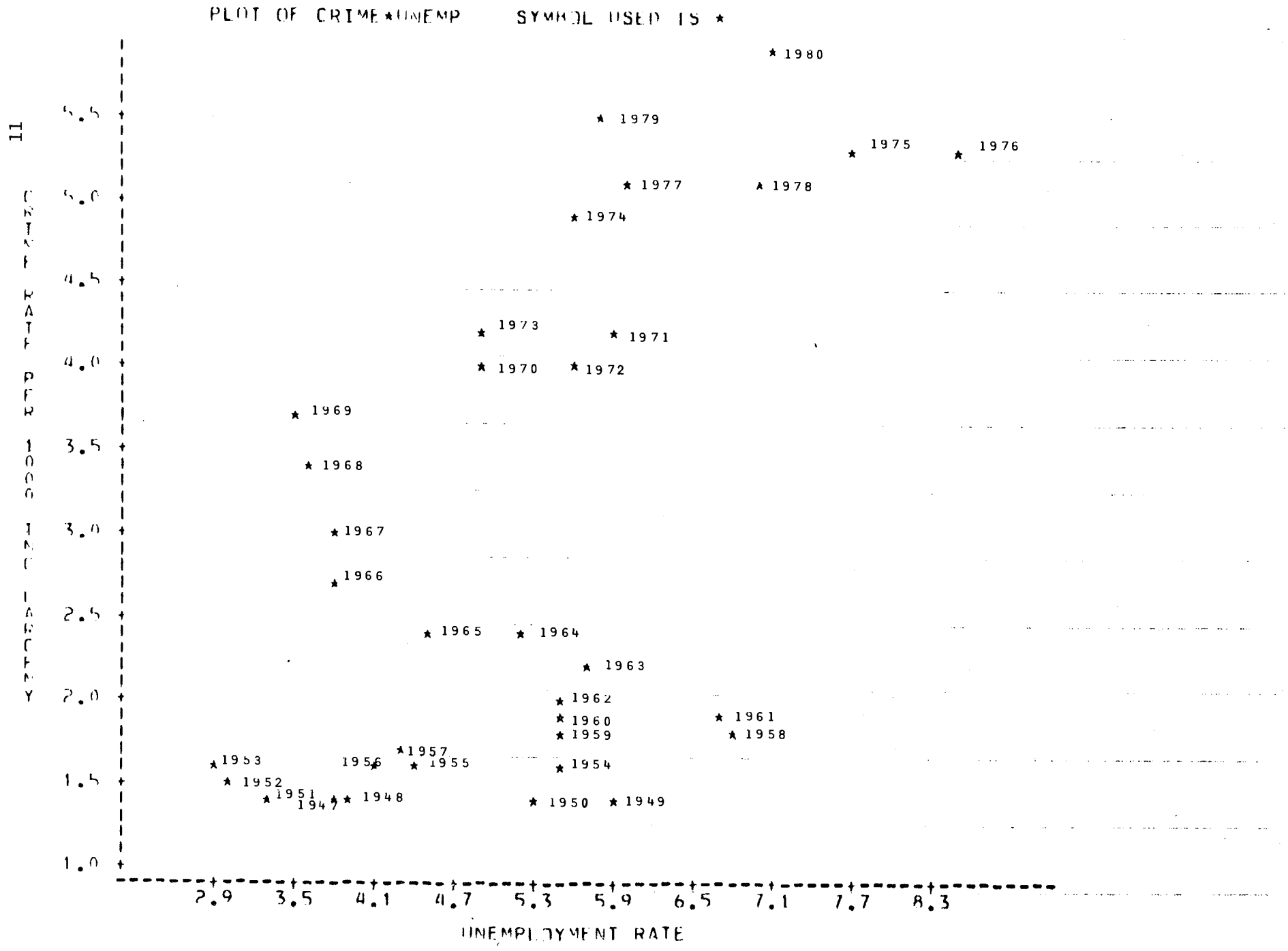
- indicates did not include variable in analysis

part fend on their own. Presumably the group with jobs would have a lower crime rate. Since individuals would be assigned to the groups one could be able to infer the direction of causality of any linkage as being from unemployment to crime. In fact, most experiments have not 'guaranteed' persons jobs but rather have provided offenders with job placement and income support for several months after prison which have more complex effects on behavior[3]. Even if the 'appropriate' experiment worked, we should note the danger of 'experimental contamination' in the sense that jobs generated by a governmental program may differ from those generated in a free market.

In short, none of the methods used to study the labor market - crime link are perfect. Each provides a potential answer to somewhat different questions, and each is subject to the problems of nonlaboratory data analysis. If each method yielded similar results, we might indeed be 'beating a dead horse here,' and we would have a unanimous concensus. As we shall soon see, however, the methods yield somewhat different results, requiring a careful assessment of the meaning and consistency of the work.

The Time Series Results

Table 1 provides a capsule summary of the results of a variety of time series analyses of the link between labor market factors and crime, and where available of the link between deterrence variables, (such as chances of being convicted, length of criminal sentences) and crime as well. The models vary greatly in time coverage, explanatory factors, and in statistical technique, ranging from single regressions


PLOT OF CRIME*UNEMP SYMBOL USED IS *
CRIME RATE PER 100 INCIDENCY
UNEMPLOYMENT RATE
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5.0
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2.0
1.5
1.0
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4.1
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FIGURE 1

of changes in crime on changes in unemployment (Phillips) to sophisticated time series systems models (Phillips and Ray). All of the models examine the effect of unemployment rates on crime; some also examine the effect of labor force participation rates; because of collinearity with time, only a few also look at other labor market variables, such as income; three contain deterrence variables whose impact can be compared to that of unemployment, in terms of significance or magnitude.

The general finding from these studies is that unemployment and/or labor participation rates have the expected impact on crime rates, but that the effect tends to be modest in magnitude, explaining little if any of the upward trend of crime in the periods studied. The labor participation rate is often found to have a closer link to crime than unemployment, suggesting that those who leave the labor force are the most crime prone. In the few studies which include income variables, the level of income (interpreted as a measure of gains to crime) was positively related to crime; while income inequality is also found to be positively related to crime. The three studies which included deterrent variables found them to be more closely related to crime than were the labor market variables.

To provide a flavor of the time series evidence, I have graphed in figure 1 the relation between the uniform crime rate and unemployment rate for the period 1947 to 1980. The crime rate is dominated by an upward trend but there is a definite cyclical component related to unemployment which can be seen in the scatter diagram. A

Long, I have made a crude tabulation of the results of these studies, dividing the findings into four categories: Those with strong (statistically significant) effects in the expected direction; those with weak (insignificant) effects in the expected direction; and those with strong and weak effects in the opposite direction. The results for unemployment (or labor force participation), for income variables viewed as measures of the incentive to commit crime and as the incentive to choose legitimate work, and criminal sanctions, are given in Table 2 in terms of the number of studies fitting into each category. Because analysts usually estimate more than one equation, with somewhat different results, the categorization is rough, based on an overall evaluation of the findings. While undoubtedly one could change some of the classifications, the table provides a reasonable picture of the tone of results.

With respect to unemployment the majority of studies yield insignificant relations between unemployment and crime but of those that yield significant results, all are in the "correct" direction and the majority show a positive relation. Whether this is to be taken as strong or weak evidence for the existence of an unemployment - crime relation is up to the reader to decide for him or herself. The preponderance of evidence is more favorable to a positive linkage than not, but if one was anticipating an overwhelmingly strong relation, one will be severely disappointed.

multivariate regression of the crime rate on the unemployment and a trend variable (with allowance for serial correlation) yields an estimate of the effect of a one unit change in unemployment on the uniform crime rate per 100,000 inhabitants of .05, of moderate statistical significance[4]. This coefficient indicates that a doubling of the unemployment rate from 5 percent to 10 percent would raise the crime rate by 5 percent in the 1980s, though whether this would represent a permanent increase in crime or simply a shifting in crime from the low to high unemployment year cannot be determined.

Overall, while not all of the analyses in Table 1 yield significant results and while none show unemployment to be the dominant determinant of crime, they lend overall support to the notion that crime varies over the business cycle.

The Cross-Section Results

There have been a large number of studies comparing crime rates across states, cities, or SMSAs. Sample sizes, variables included, and the periods covered differ considerably. In recent years many of the studies have been of a simultaneous equations type, with restrictions designed to identify the effect of deterrent variables; the labor market factors are always taken as exogenous. A typical model includes an equation relating crime to criminal penalties or resources spent on police, labor market conditions, and other factors; and a second equation for the level of criminal penalties or police resources.

From the reviews of the literature by Gillespie and Witte and

The results with respect to other labor market variables are similar. Income of the overall population in an area taken as a measure of the possible gain from economic crime and various measures of the income of the poor, often the fraction of the population in poverty, viewed as an indicator of the opportunity cost of crime, obtain estimated effects which are in the right direction, and significant in a fair number but not a majority of cases.

For purposes of comparison Table 2 also provides a count of estimated effects of criminal sanctions. Here, the results are noticeably stronger, with the majority of studies finding strong impacts in the anticipated direction.

There are two possible reasons for the differential impact of the labor market and deterrence variables. One possibility is that considerable effort has gone into measuring deterrence while the labor market factors, usually entered solely as "controls," have not received such careful attention. As a result, it is likely that the deterrence variables are better measured than are the labor market variables, biasing the coefficient of the latter toward zero relative to the coefficients of the former[5]. For example, most cross-section studies use a simple aggregate unemployment rate whereas the level of crime among young people out of the labor force suggests a youth-out-of-labor-force measure would be better. A second related reason may be the different specificity of the variables: deterrence variables relate <u>directly</u> to the options facing potential criminals, while general labor market variables do not: the potential criminal may be

TABLE 2: Scorecard for Results of Cross-Sectional Analysis of Labor Market Crime Link

	Number of studies with specified link to crime			
	Stong Correct Direction	Weak Correct Direction	Weak Incorrect Direction	Strong Incorrect Direction
1. Unemployment	4	7	4	0
2. Income as Incentive to Commit Crime (Average Income)	5	3	3	1
3. Income as Cost of Crime (Income of Poor; Percent of Population in Poverty	4	3	1	0
4. Criminal sanctions	10	3	4	0

Source: Based on the following studies listed in the bibliography: Allison, Bartel, Ehrlich (1974, 1979), Fleisher, Forst, Greenwood and Wadycki, Greison, Gylys, Hoch, Land and Felson, Mathur, McPheters and Stronge, Nagel, Pogue, Quinney, Sjoquist, Swimmer, Weicher.

they will have lower skills, lower wages when working, and considerably more unemployment than the average (see Table 3 for documentation). Isn't this clearcut evidence that unemployment and poor labor market performance are a major cause of crime? Why does it, on the face, tell a stronger story than the time series and cross-section evidence just examined?

There are several possible explanations for the stronger relation between unemployment and labor market performance in the individual than in aggregate data.

(1) The individual data may not be reflecting the effect of unemployment (other labor market failures) on crime but, rather, the fact that the criminal population consists of people who are unable to succeed in the mainstream society due to "underlying personal characteristics." That is, the cause of both the unemployment and criminal activity may be a third variable having to do with the individual's attributes. If this were the case, changes in labor market conditions would have little or no effect on the person's life in crime, although we would always find the criminal having a poor work record.

quite responsive to his own unemployment (or wage) prospects but those prospects may be only weakly related to aggregate market conditions.

Finally, how should we assess the scorecard results in Table 2? In its evaluation of studies of the effect of deterrence on crime, the NAS-NRC Panel on Research on Deterrent and Incapactitative Effects concluded that "we cannot yet assert that the evidence warrants an affirmative conclusion regarding deterrance . . . (although) . . . the evidence certainly favors a proposition supporting deterrence more than it favors one asserting that deterrence is absent. . . ." (p. 7) As the results with deterrence variables are generally stronger than those with labor market variables, readers who agree with the Panel conclusion will be even more circumspect in reaching the affirmative conclusion regarding unemployment and other labor market factors. They will agree with Orsagh and Witte that the economic model of crime, "as that model relates to unemployment and income is not confirmed by tests performed on aggregate data sets" (p. 8). After all, more coefficients on the labor market variables are insignificant than significant. My view is more positive with respect to both the deterrence and labor market results. It is, however, clear that the evidence is not strong enough to yield Congressman Conyer's 'unanimous consensus.'

Studies of Individuals

Take a group of convicted criminals. Compare their work record with that of other citizens of the same age and sex. Invariably one will find that the criminals will have a much more spotty work history:

(2) The potential criminal may have chosen unemployment in preparation for criminal activity. He/she could have had a job but turned it down in favor of criminal activity. In this case unemployment per se is not the cause of crime, though the overall rewards from work relative to crime may have influenced the individual's decision.

(3) Potential criminals are, indeed, responsive to unemployment and legitimate earnings opportunities, but as argued earlier their economic choices are weakly linked to the overall economy, so that aggregate analyses fail to capture the micro-relation. This would be the case if criminals tend to come from the back of the 'job queue' so that their employment chances are only vaguely affected by the overall level of unemployment: when the market is good, employers hire other workers before the potential criminal, with the result that it takes huge swings in the overall level or special programs to raise their employment chances.

These three explanations suggest that the unemployment - crime link found in comparison of criminal and noncriminal work records cannot be used to infer what happens to criminal activity when labor market conditions change. Explanations (1) and (2) differ fundamentally from (3), however, in that they suggest that changes in unemployment/legitimate wage possibilities for criminals are (within normal ranges of variation) likely to have little impact on their criminal behavior whereas (3) suggests that if properly measured the market opportunities facing the potential criminal would indeed reveal

TABLE 3: Preimprisonment Work Experience of Arrestees

	Georgia	Texas	Washington D.C.
A. Proportion unemployed at time of arrest	48%	47%	46%
B. Type of employment			
Unskilled labor	45%	15%	41%
Semiskilled labor	48%	62%	11%
C. Reported wages earned per week	$136	$148	
D. Percentage earnings below $3.00 per hour			50%

Source: Georgia and Texas, for TARP participants from Rossi, Berk, and Lenihan, Table 7.6, p. 131. Washington D.C. from "A Supplemental Report by the Office of Criminal Justice Plans and Analysis" in Unemployment and Crime Hearings, pp. 111 - 112.

"supported work" , in which a major effort is made to provide a social environment encouraging work as opposed to crime. These studies give us an indication of how ex-criminals (who, because of recividism and the concentration of crime among a small subset of the population, can be assumed to cause a large proportion of crime) respond to their <u>own</u> labor market incentives. They also have the advantage that the incentives are controlled by the experimenter, providing a truly exogenous labor market variable for study. If these studies showed a strong link between unemployment (other labor market factors) and crime, the case for a sizeable significant relation would be greatly enhanced.

Unfortunately, like the other evidence in the field, these studies, while generally supportive of a labor market - crime link, do not give a uniform picture either of our ability to alter labor market opportunities to reduce criminal behavior or the relation between unemployment or earnings and crime. As Table 4 shows, some studies have successfully altered behavior (the Baltimore LIFE experiment, Project Wildcat, Operation Pathfinder) while others have not done so (Parole Reintegration Projects, Supported Work, Project Development Support Services, the diverse manpower programs surveyed by Taggart).

The recent and statistically sophisticated study of the TARP experimental program, by Rossi et al showed essentially no difference in recividism between the experimental group (who received unemployment compensation so that they could better search for jobs after release

a significant response to these opportunities.

Studies of recividism among actual releasees provide one, albeit imperfect, way of analyzing the response of one set of potential criminals, ex-offenders, to their own labor market experience. In an analysis of 641 men who were in prison in North Carolina in 1969 or 1971 Anne Witte found that whereas the wage level received on their first job tended to decrease arrests or conviction the variable measuring unemployment had an unexpected negative effect as well, giving a rather mixed picture of the effect of labor market on the behavior of these persons. The Rossi-Berk-Lenihan analysis of TARP participants in Texas and Georgia, by contrast, showed a significant tradeoff between number of arrests and weeks employed, with those employed longer having fewer arrests. In addition, however, they found a weak or anomalous relation between their measure of the labor market (unemployment in the county of the release) and the individual's employment experience, so that the aggregate market variable had no effect on the individual's behavior.

At present there are too few studies of individual behavior to reach any overall assessment.

Results of Social Experiments

In recent years several social experiments have been developed to evaluate the responses of ex-offenders to job market incentives. The programs have varied from job placement, to provision of money to give ex-offenders some financial security until they find a job to

from prison) and the control population. Rossi et al develop a model explaining the failure of the program to reduce crime as resulting from the negative impact of employment on crime and the sizeable impact of unemployment compensation on acceptance of jobs. Viewed in this light, the TARP experiment supports the link between unemployment and crime, although the experiment itself did not succeed due to failure to allow for greater unemployment for those receiving unemployment compensation. However, as noted earlier, there was little relation between aggregate labor market conditions and recividism. By contrast the Baltimore LIFE experiment, on which TARP was modeled, found a stronger link between unemployment in the city and crime than between the individual's own work experience and crime. While these two studies lend some support to the unemployment - crime link, there are enough failed experiments to call into question our ability to predict how the labor market - crime link will indeed operate in a particular instance.

Conclusion

So, what in fact do we know about the relation between the labor market and crime?

As a broad generalization, the bulk of the studies examined here show some connection between unemployment (and other labor market variables) and crime but they fail to document a well-defined clearly quantifiable linkage. We know:

(1) There is a cyclical pattern to crime rate, with crime rising over the cycle with unemployment.

TABLE 4: Some Experimental Studies of the Effect of Economic Incentives on Recividism

Program (Analysis)	Results of Providing Economic Incentives
1. Transitional Aid Research Project, prisoners given up to 6 months of unemployment insurance to reduce economic incentive for economic crime [Rossi, et al].	Work disincentives of TARP reduced employment, increasing crime, while payments reduced crime, for those with some employment, with no net effect. Large unemployment-crime relation.
2. Baltimore Living Insurance for Ex-Prisoners(LIFE) Project, ex-prisoners given financial aid and job placement services [Rossi, el al; Mellon and Thornton; K. Lenihan	Financial aid reduced crime; unemployment in city at time of release also affected crime, no job placement effects.
3. Supported Work Experiment, ex-offenders provided with subsidized employment and social support for working [Manpower Demonstration Research Corporation]	No sizeable significant effects on crime.
4. Diverse Manpower Programs for Ex-Offenders, a variety of vocational training and placement programs [Taggart]	Programs generally ineffective.
5. Project Wildcat, employment and social support for ex drug addicts [Vera Institute]	Reduced criminal activity but many employed controls had high recividism
6. Parole Reintegration Projects: stipends or grants given to parolees to ease transition to work [Taggert; Pilavin and Gartner]	Little postive impact.

market on crime is not an open-and-shut case in which research results are so definitive that there is no need for further work. The work is, however, more supportive of a link than of the opposite conclusion.

(2) There is evidence that criminals tend to have poorer work records than noncriminals, but only limited evidence that, once a person embarks on crime, moderate changes in these market opportunities will cause them to choose legitimate earnings channels.

(3) Cities and states have widely different crime rates loosely linked to labor market conditions.

(4) In studies that include measures of criminal sanctions and labor market factors, sanctions tend to have a greater impact on criminal behavior than market factors.

How is the reader to evaluate the results?

For the person who strongly believes unemployment causes crime, there is nothing in the empirical evidence to cause him/her to abandon that belief. Weak or modest empirical support should not strengthen one's belief, but also should not lead one to abandon an initial strongly held view. On the other hand, the stronger evidence on the deterrent effect of sanctions, should alter one's view of the relative impact of the "carrot" and the 'stick.'

For the person who believes crime is unaffected by the labor market, there is also no reason to abandon his/her views, though he/she should be moved in the direction of believing "there is some difficult-to-measure relation."

Overall, returning to Congressman Conyer's question with which we began the essay -- the impact of unemployment and the labor

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FOOTNOTES

1. This work was pioneered by Fleisher, Becker, and Ehrlich.

2. These are described later in this essay.

3. Unemployment aid after release, for instance, reduces the need to engage in crime to make money but also may keep a person unemployed for a longer period of time, increasing the likelihood of criminal activity, if unemployment leads to crime. See Rossi et al.

4. The specific regression result is

$$\text{crime} = \underset{(1.55)}{+ .05\ \text{unemployment}} + \underset{(9.02)}{.13\ \text{time}}$$

$R^2 = .75 \quad p = .84$

where the numbers in parentheses are t-statistics, R^2 is the proportion of variance explained and p is the first order serial correlation parameter.

5. While in a multivariate regression one cannot be certain of the impact of measurement error in one variable on another due to correlations between variables and possibly between measurement error in one and other variables, under reasonable assumptions the result in the text is correct.

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