NBER WORKING PAPER SERIES

WORK AND CRIME: AN EXPLORATION USING PANEL DATA

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Working Paper No. 4794

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1994

The ordering of the authors' names was decided randomly; all work is joint. We would like to thank Marvin E. Wolfgang of the Center for Studies in Criminology and Criminal Law at the University of Pennsylvania for providing us with data and Neil Weiner, also at the Center, for invaluable assistance with the data and for information about the Philadelphia criminal justice system. Terence Thornberry, Dean of the School of Criminal Justice, State University of New York, Albany, also provided helpful insights regarding the data and their use. Kevin Lang, Daniel Nagin and Robin Sickles provided valuable comments on earlier drafts. Finally, we would like to thank the National Science Foundation for the funding that made the research possible. This paper is part of NBER's research program in Labor Studies. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

In this paper we explore the relationship between crime and work using data for a cohort sample of young men. We find that working and going to school significantly decrease the probability of committing criminal acts and by virtually identical amounts. Parochial school education and higher IQ are also significantly associated with lower criminal proclivities, but a high school degree has no significant effect. These findings, in conjunction with other research, suggest that participation in legitimate activities (employment or school) per se has a greater effect on criminal behavior than does the higher income associated with employment or educational attainment.

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In this paper, we consider the legitimate and criminal activities of young men. We are interested primarily in the relationship between young men's criminal activity and their employment. We use data for a birth cohort sample that contain information of the activities of a representative sample of young men over a seven-year period.

Beginning with Ehrlich's [1973] extension of Becker's [1968] pioneering work, economists have sought to model the nature of the relationship between employment and crime. These economic models generally see crime as like employment in that it takes time and produces income. The simplest of these models predicts that crime and work are substitutes. The implication is that increasing the availability of jobs and improving wages lowers the level of criminal activity. Empirical researchers have been unable, however, to provide strong, consistent and convincing evidence in support of this theoretical proposition.

In light of these findings, we stepped back and surveyed empirical work, including ethnographies, on crime. This work provides important stylized facts. First and foremost, crime is a young man's game. In 1990, seventy percent of the individuals arrested in the United States were between 16 and 34 and over 80 percent of those arrested were male. Second, during their prime crime years (the late teens and early twenties), young men are often actively involved in educational pursuits. Only forty-five percent of the population between 16 and 19 years of age was employed in 1990. Third, ethnographic studies find that many criminal activities require relatively little time and are often combined with employment or education. In addition, participation in criminal activities has many distinctive attributes (e.g., flexible hours, immediate gratification rather than a weekly paycheck, independence, excitement, flashy life style) that makes it attractive to young males.

In this paper, we develop a model that reflects the above stylized facts and use a data set that has a number of unique elements. Our data contains information on the criminal, work and educational activities of a representative sample of young males in a large U.S. urban area. The study traced the activities of the young men from ages 19 to 25. This is the period during which there is the greatest mixing of work, schooling, and criminal activity.

Our work differs from most previous research in that we use data for a general population group, control for deterrent effects and consider educational as well as employment activities of young men. Most work on the relationship between employment and crime has used data for "high risk" populations such as prison releasees. The work either ignores deterrent effects or considers only specific (the effect of punishment on the individual punished) and not general (the effect of punishment on individuals without contact with the criminal justice system) deterrent effects. Much of the work considers employment but not educational activities.

The organization of the remainder of the paper is as follows. In the next section, we review the empirical literature. In Section II, we present the model that structures our empirical work and in the following section we describe the data and the empirical model. Section IV contains our empirical results and the final section our conclusions. To preview briefly our results, we find evidence that both employment and going to school are associated with less crime. The effects of schooling and employment on crime are virtually identical.

I. The Literature

Most theoretical models of crime are single-period individual choice models.[1] These models generally see the individual as deciding how to allocate time with criminal activity as one possible time use. Criminal activity is represented as being similar to employment in that it requires time and produces income. For convenience, we refer to such models as "crime as work" models.

The bulk of empirical work by economists has used aggregate data on crime rates, usually data obtained from the FBI's Uniform Crime Reports (UCRs), to estimate crime as work models.[2] This work has been severely criticized for aggregation bias, arbitrary identifying restrictions, and poor data.[3]

Beginning in 1980, a small, but increasing, number of studies used individual, generally cross sectional data, to estimate economic models of crime (e.g., Good, Pirog-Good and Sickles, 1986; Montmarquette and Nerlove, 1985; Myers, 1983; Viscusi, 1986a, 1986b; Schmidt and Witte, 1984; Witte, 1980). Since this work relates most closely to our own, we concentrate our review on this literature. For completeness, we also discuss briefly some relevant work by sociologists (e.g., Rossi, Berk and Lenihan, 1980; Thornberry and Christenson, 1984) and psychologists (e.g., Farrington, et al., 1986; Gottfredson, 1985).

In the first half of the 1980s, a number of economists used data for prison releasees to estimate models of criminal activity (e.g., Witte, 1980 and Myers, 1983). This work often had limited information on employment activities and no information on educational activities. For example, Witte uses the length of time required for releasees to find a job and the wage on the first job after release to reflect work activities. She has no information on educational activities. Further, studies using cross sectional data for prison releasees cannot reveal how legitimate activities affect the decision to commence criminal activity. It can only reveal the effect of employment on the resumption of such activities.

Recent work using individual data has attempted to overcome some of the difficulties outlined above. Montmarquette and Nerlove [1985] and Thornberry and Christenson [1984] use data for general population groups. Farrington, et al. [1986], Good, et al. [1986], Gottfredson [1985] and Thornberry and Christenson [1984] use data that contain observations for at least two time periods. Only Farrington, et al. [1986] and Thornberry and Christenson [1984] have panels that extend over a number of years (four years in each instance).

These studies, however, do not use panel data estimation techniques. In addition, many of the studies fail to take account of the qualitative or limited nature of measures of criminal activity.

Furthermore, existing work with individual data does not control for possible deterrent effects arising from the actions of the criminal justice system. Indeed, some studies (e.g., Rossi, et al. 1980; Thornberry and Christenson, 1984) contain no deterrence variables.[4] Other studies address specific but not general deterrence issues by including variables that reflect the individual's perceptions or past experience with the criminal justice system (e.g., Montmarquette and Nerlove, 1985; Myers, 1983; Schmidt and Witte, 1984; Viscusi, 1986a, 1986b; Witte, 1980).

II. Conceptualization

As is usual, we assume a von Neumann-Morgenstern decision maker. In contrast to existing work, we see the individual as choosing a level of criminal activity, denoted c, rather than the time to allocate to crime. We choose this approach because studies indicate that most criminal acts are unplanned[5] and that crime commission does not take much time (e.g., Hirschi, 1969; Crowley, 1981). We allow for the possibility of nonmonetary gains from crime by entering the gains from crime, denoted R(c), directly into the utility function. This reflects the fact that many offenses yield no direct monetary gain (e.g., assault, drug use) and that even major property crimes produce surprisingly low monetary returns [Petersilia, Greenwood, and Lavin, 1977; Swanson and Tabbush, 1988; Viscusi, 1986a].[6] Formally, the individual's utility with income from legal activities I, offense level c, and sanctions s is

$$U(I,R(c),s;\dot{a}^0)$$

where a^0 denotes a vector of exogenous variables systematically related to preferences.

To reflect substantial evidence that criminal justice system actions depend on the number and type of offenses,[7] we posit functions that relate the probability that an individual is arrested and the sanctions to the extent of the person's criminal activity. These functions may shift because of differences in individual abilities to avoid arrest and to mitigate punishment, denoted a^i, and because of exogenous changes in the criminal justice system (e.g., the availability of resources, administrative policy, and the legal code), denoted b. Let $P(c;a^i,b)$ denote the probability of arrest and $S(c;a^i,b)$ the level of sanctions.

Our conceptualization of criminal justice actions differs from that in most economic models of crime by seeing such actions as dependent on both the individual's criminal activity and exogenous shift factors. This has important implications for empirical work. For example, consider the implications of the model for how to measure the arrest probability in empirical work. As represented in the model above, an individual contemplating a criminal act does not face a single probability of arrest. Rather, the individual faces a schedule or function that relates each possible level of criminal activity to a probability of arrest. As pointed out by Cook [1979] and Poterba [1987], it is possible to estimate the effect of the probability schedule on crime only if there are exogenous shifts in the schedule. Under the model developed above, such exogenous shifts occur because of differences in individual abilities to avoid arrest and because of differences in police resources, police administration and the legal code. Variables reflecting such shifts and not the probability of arrest enter the crime equation.

For notational simplicity, we ignore the possibility of multiple arrests and assume that in any time period the individual is either arrested once or not at all.[8] The individual chooses the level of criminal activity to maximize expected utility given by

$$EU = P\ U(I,R(c),S(c;a^i,b);a^e) + (1-P)\ U(I,R(c),0;a^e).$$

With this model, the optimal level of criminal activity, c^*, depends on total income from legal activities, the preferences of the individual, and exogenous factors that cause the probability or sanctions functions to shift. We do not view criminal activities and employment as being jointly determined. Crime and employment are not necessarily substitute time uses. This is consistent with findings that crime and work are often combined (e.g., Holzman, 1982; Phillips and Votey, 1985).

III. The Data and Empirical Model

Our primary data are for a 10 percent random sample of males born in 1945 and residing in Philadelphia between their 10th and 18th birthdays. We combine this individual information with data on the total number of offenses, police budgets, macroeconomic indicators and neighborhoods in Philadelphia. Information was collected from school records, draft registration records, the Philadelphia Police Department, the FBI, a compendium on city government finances, the Philadelphia Community Renewal Program, and interviews carried out in 1970-1971.

Using this data, we created two panels, one a seven-year panel that traces cohort members' activities from 1964 through 1970 and the other an eight-year panel that ends in 1971. Since almost half of the interviews were conducted in 1970, the seven-year panel contains approximately twice the number of observations as the eight-year panel. The results discussed in the paper are for the seven-year panel. Results for the eight-year panel and more details on the data are available in Tauchen, et al. [1988].

To estimate our model, we require measures of the total income from legal activities, the preferences of the individual, and exogenous factors that cause the probability or sanction functions to shift. There are two primary measurement issues for this study, namely how to measure the level of criminal activity and how to reflect the criminal justice system actions. We use two measures of criminal activity. The first is a binary measure for whether or not the individual was arrested during the year. Although this is one of the most commonly used measures of criminal activity, it is well-recognized that

such binary variables do not reflect the seriousness of the crimes committed or even the frequency of arrests. Given the differences in the types of crimes committed by our sample members', we also used Sellin and Wolfgang's [1964] crime seriousness index to measure the level of criminal activity. Their index assigns a seriousness score to each crime for which the individual was arrested, and the seriousness scores for all arrests during the year are summed to obtain the crime index for the year.

The second measurement issue relates to criminal justice system actions and general deterrence. Both our model and empirical evidence indicate that criminal justice system actions depend on the level of criminal activity, on the individual's ability to avoid arrest and on exogenous factors related to the criminal justice system. Since the actions of the criminal justice system depend on an individual's criminal decisions, the individual's own experience with the criminal justice system cannot be used as a general deterrence variable. Most of the observed variation in individuals' experiences with the criminal justice system results from differences in crime seriousness and crime frequency not from exogenous criminal justice system actions. Appropriate measures of general deterrence are numerical representations of exogenous changes in the criminal justice system. These variables must reflect variation that does not depend on the type and extent of criminal activity. Appropriate measures include changes in criminal justice resources and policies. Since there were no major changes in criminal justice system policies in Philadelphia during the study period, we use a number of variables related to the level of resources available (e.g., the real police budget per offense and per capita) as our measures of general deterrence.

We are not able to measure the income from legal activities directly since there are no income or wage variables in our data set. We have information, however, on the time allocated to work and on factors generally correlated with wages (i.e., IQ and a binary for whether or not the individual received a high school degree) and incorporate these variables to reflect income from legal activities. Our data set also contains information on the

time allocated to school during each year and we incorporate this variable in order to control for educational activities.

The variables related to preferences are of three types: (1) variables that reflect family and community backgrounds (i.e., a binary equal to one if both parents were born in the U.S., a measure of the occupational status of the household head when the boy was in high school, a binary equal to one if the boy attended primarily parochial schools, the number of addresses during the school years, average income in the neighborhood of residence during high school); (2) variables reflecting personal characteristics (i.e., IQ, a binary equal to one if the individual is white); (3) variables reflecting activities that occurred during the juvenile or young adult years (i.e., three variables indicating the type of charge at first arrest, the number of police contacts as a juvenile, the percent of juvenile police contacts resulting in formal criminal justice system processing, a binary equal to one if the individual is married, and a binary equal to one if the individual was a member of a gang as a juvenile). Finally, we include a variable for the year of the panel to reflect the aging of the cohort and other trend factors.

Most variables likely to reflect differing abilities to avoid arrest (e.g., intelligence or like-minded friends) are also likely to be related to differences in the individual's "taste" for crime. To reflect this confounding of effects, we interpret the coefficients on such variables as reflecting some mixture of preference and deterrence effects.

We estimate the models for the binary measure of criminal activity using a random effects probit model. The two-factor random effects probit model is an extension of the usual probit model. In the two-factor random effects models, the disturbance terms are correlated across time for any individual but not across individuals. The component of the disturbance term that is correlated across time for any individual reflects unmeasured, persistent individual effects. If the error is uncorrelated with the explanatory variables, the parameter estimates of the error component probit model are consistent and asymptotically efficient [Chamberlain, 1984].

IV. Empirical Results

Table I contains empirical results for the binary measure of criminal activity. The first column is for a specification including only variables that are unaffected by an individual's criminal or time allocation decisions (e.g., police resources, family background and neighborhood characteristics). The second column contains results for a specification that also includes predetermined variables related to the juvenile criminal record. The last column is for a specification including variables related to activities that occurred in the current year (e.g., fraction of the year employed) or previous years, possibly during the sample period (e.g., high school graduation). We estimate three specifications as a partial check of the robustness of results. The implications of the Tobit models are similar to those of the probit model, the estimated coefficients are not reported. The results are available in Tauchen, et al. [1988].

The probit and Tobit models are significant in all specifications and the estimated coefficients, when significant, are of the same sign in all models. The estimated coefficients on the variables of primary interest are stable in sign and magnitude across specifications for a given estimation technique. We find greater time working, greater time in school and higher IQ to be significantly related to lower probabilities of criminal activity. The receipt of a high school diploma, however, has no significant effect on offending for any specification or panel. Upon considering only the results for the time allocated to work and IQ, we could interpret our findings as indicating that a lower level of criminal activity is associated with greater income.[10] In light of the results for the high school degree binary and the time allocated to school, the interpretation is less clear cut.

The coefficients on the proportion of time working and the proportion of time school are not significantly different from one another. Other studies (e.g., Farrington, et al., 1986; Gottfredson, 1985; Viscusi, 1986a) obtain the same results.[11] The standard economic explanation for this finding is based on a dynamic, human capital model of criminal behavior (e.g., Flinn, 1986).

Current employment and schooling could have similar effects since both affect permanent income. Employment has an obvious, direct bearing on current and permanent income. Schooling influences permanent income through its human capital effects on future wages and employment prospects.

Our findings for high school graduation, however, do not indicate significant human capital effects on crime. Nor can the insignificant coefficients on the high school graduation variable be explained by collinearity. Also, other researchers (e.g., Schmidt and Witte, 1984) report that wage rates are not significantly related to criminal actich as Philadelphia. The human capital effects of parochial school attendance do not, however, lead to higher incomes. Kessler [1990] reports that graduates of parochial schools are more likely to have white-collar jobs than public school graduates but that there is no significant difference in their wages, ceteris paribus.

The results of other researchers and this study might be consistent with a model of criminal activity that conceives of legitimate time uses and social associations (e.g., partch as Philadelphia. The human capital effects of parochial school attendance do not, however, lead to higher incomes. Kessler [1990] reports that graduates of parochial schools are more likely to have white-collar jobs than public school graduates but that there is no significant difference in their wages, ceteris paribus.

The results of other researchers and this study might be consistent with a model of criminal activity that conceives of legitimate time uses and social associations (e.g., participation in church activities, white collar employment) as shaping or revealing preferences concerning illegal activities. Such a model might be developed by allowing the parameters of the utility function to depend on how an individual uses time or on an individual's associates [Theil, 1980; Phlips, 1983; Becker, 1992][12]. Note that this approach would not be inconsistent with standard economic models. Further, such an approach might address the criticism that economic models of

crime are not applicable for teenage offenders, particularly young teenagers, few of whom are in the labor market [Felson, 1993].

The negative coefficient on the binary for whether the individual was white[13] is consistent with the common finding that nonwhites have far higher crime participation rates than whites (e.g., Blumstein, et al., 1986). In our sample, though this finding could be partly attributable to characteristics of the criminal justice system. A study that uses the same data set [Collins, 1985] reports that blacks were more likely to be arrested given the crime committed than were whites. Since we use arrest to measure criminal activity, the estimated coefficient on the binary for whether the individual was white reflects differences in police arrest practices as well as differences in criminal behaviors across racial groups.

As in other studies that use official crime data, we find that the probability of arrest is higher for young men whose household head during high school had a relatively low status occupation. In light of this result, it may seem surprising that young men who grew up in higher income neighborhoods were more likely to be arrested in their early adult years. This is a common result, however, in studies that use neighborhood or other aggregate measures of income. In previous studies, researchers interpret the average community income as measuring the opportunities for crime and often find this variable to be positively related to the crime rate[14]. The findings related to the young men's juvenile criminal record and to the other family background variables are also consistent with the previous literature.

We find robust and significant general deterrent effects from greater criminal justice system resources. For the results reported in Table I, the criminal justice resource variable is measured as real police resources per offense for the city of Philadelphia, and the estimated coefficient is negative and significant. We also find significant deterrent effects for the following measures of criminal justice resources: police officers per offense, total criminal justice employees (police, courts, and local corrections) per offense, real police budget per young male, and real police budget per capita.

In considering these general deterrence results keep in mind that our measure of crime is arrests. The net impact of increased criminal justice resources on arrests is the sum of two opposing effects. Increasing criminal justice resources may have a deterrent effect on the level of criminal activity but also leads to a higher probability of arrest for any given crime. The estimated coefficients on the criminal justice resource variables therefore understate the pure general deterrent effect. See Tauchen, et al., [1994] for a detailed discussion.

V. Conclusions

As in previous studies,[15] our findings provide little evidence that wages or incomes have consistently significant effects on crime. Our work does add to the growing literature that finds both employment and school attendance to be significantly related, in virtually identical ways, to lower levels of criminal activity. Similar effects for employment and schooling are difficult to explain using either a static crime as work model or the static demand-type model developed in Section III. Perhaps different types of criminal models will offer greater insights regarding the effect of legitimate time uses on criminality. Researchers have begun to develop dynamic models of criminal activity (e.g., Flinn, 1986; Davis, 1988] and models of crime based on psychological and sociological processes (e.g., Akerlof and Dickens, 1982; Dickens, 1986; Lattimore and Witte, 1986; Lattimore, et al., 1992). Gary Becker is currently developing models for the "rational formation" of preferences based on habitual behavior and peer group influences [Becker, 1992]. This work, like Becker's 1968 article, may change how researchers model criminal activity.

Endnotes

1. For a survey see Heineke (1978) or Schmidt and Witte (1984).

2. Some economists (e.g., Cook and Zarkin, 1985) have estimated statistical time series models.

3. See Blumstein, et al.(1978), Brier and Fienberg (1980), Cook (1980), Long and Witte (1981), or Freeman (1983) for surveys.

4. Good, et al. (1986) use a police policy variable that might under our model be interpreted as a general deterrence variable. However, neither their model nor empirical results are consistent with such an interpretation.

5. Erez (1987) provides a good survey of the research on how offenders approach crime. She concludes that "criminal violations are mostly situational and that impulsive crime is more common than planned crime" (p.132).

6. Selling drugs may be an exception. See Freeman (1991) for a recent survey of the income of drug dealers.

7. See Tauchen, Witte, and Long (1991) or Blumstein, et al. (1983) for discussions of the general determinants of criminal justice system actions.

8. The notation with multiple arrests is messy and complicated. The implications of the model for structuring the empirical work are the same as for the above model.

9. Members of the sample had 147 arrests during the sample period. Eight percent of these arrests were for crimes with potential or actual violence (homicide, rape, assault, and robbery), 25 percent involved theft of property (burglary, larceny and motor vehicle theft) and the remaining arrests involved offenses such as drug sales and possession, and buying and receiving stolen property.

10. The negative coefficient on the IQ variable might also arise because more intelligent individuals are better able to elude arrest for their criminal acts than are others.

11. As Viscusi (1986a) and others have pointed out, the coefficients on variables such as employment and schooling must be interpreted with care. In a standard human capital model, these coefficients might be regarded as partial correlations with the arrest variable.

12. In dynamic models there are other possibilities. For example, one might incorporate state dependence (for a discussion of a possible approach see Heckman, 1981) or the type of "taste shifter" vector discussed by MaCurdy (1985). In an interesting discussion of dynamic demand systems, Phlips suggests that taste changes may "result from better outside information due to external influences on a consumer, or they are of the 'built-in' type, being related to past decisions" (1983, p. 178).

13. The three Hispanics in our sample were classified as nonwhite.

14. See Long and Witte (1981) for a review of this literature.

15. See Long and Witte (1981) and Freeman (1983) for reviews.

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TABLE I
RESULTS FOR THE PROBABILITY OF OFFENDING
(Asymptotic "t-ratios" in parentheses)

Independent Variable	Model 1	Model 2	Model 3
General Deterrence			
Real Police Resources Per Index Offense	-0.0192** (-2.75)	-0.0197** (-2.79)	-0.0164** (-2.38)
Total Legal Income			
IQ	-0.0156** (-2.21)	-0.0163** (-2.00)	-0.0081 (-1.15)
Fraction of Years Individual was Employed			-0.0075** (-3.40)
Fraction of Years Individual was in School			-0.0104** (-3.32)
Binary Equal to 1 if Received a High School Degree			-0.2131 (-1.33)
Age/Returns to Legal Activity			
Year	-0.0028 (-0.09)	-0.0009 (-0.03)	0.0075 (0.21)
Family Background			
Binary Equal to 1 if Parents U.S. Born	0.3068 (0.93)	0.2735 (0.98)	0.1980 (0.79)
Occupational Status of Household Head During High School	-0.0048 (-1.18)	-0.0065 (-1.54)	-0.0034 (-0.94)
Number of Addresses During Primary & Secondary School	0.1116** (2.17)	0.0138 (0.31)	0.0173 (0.41)
Binary Equal to 1 if Attended Parochial High School	-0.3823* (-1.71)	-0.4058* (-1.79)	-0.2656 (-1.37)
Neighborhood Characteristics			
Average Income in Neighborhood During High School ($1000)	0.0797 (0.68)	0.0002 (1.45)	0.0002 (1.48)
Binary Equal to 1 if High School Neighborhood Predominantly Italian	0.0739 (0.32)	0.0070 (0.03)	0.0308 (0.16)
Personal Characteristics			
Binary Equal to 1 if White	-0.5567** (-2.30)	-0.6132** (-2.50)	-0.6060** (-2.74)
Binary Equal to 1 if Married			-0.3137** (-2.014)

Table 1 continued

Independent Variable	Model 1	Model 2	Model 3
Past Activities			
Binary Equal to 1 if First Arrest a Serious Personal Crime		1.3230*** (3.92)	0.9235*** (2.99)
Binary Equal to 1 if First Arrest a Less Serious Personal Crime		0.0861 (0.29)	0.2220 (0.85)
Binary Equal to 1 if First Arrest a Property Offense		0.1824 (0.50)	0.1317 (0.49)
Number of Times in Police Custody as a Juvenile		0.1290*** (3.09)	0.1171*** (3.04)
% of Juvenile Police Contacts Resulting in Formal Criminal Justice Processing		-0.0028 (-0.71)	-0.0024 (-0.70)
Binary Equal to 1 if Gang Member		0.6968*** (3.18)	0.7035*** (3.97)
Constant	1.2440 (0.62)	0.5466 (0.26)	0.2476 (0.12)
Variance of Estimated Individual Effects	0.9534*** (11.06)	0.8683*** (6.79)	0.6668*** (5.86)
Log Likelihood	-445.52	-420.45	-410.94
N	2856	2856	2856

*Significant at the .10 level, two-tailed test.
**Significant at the .05 level, two-tailed test.
***Significant at the .01 level, two-tailed test.