AGE STRUCTURE AND CRIME RATES: A PARTING OF WAYS

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Abstract

Even though the age groups with the highest arrest rates continue to shrink, crime rates are now holding steady or rising. We explore the reasons for this tend. The identity of the high-crime age categories, and even the existence of an age/crime relationship, are far from certain. Age patterns for arrestees may differ from age patterns for offenders and for likely victims. Most research finds that age structure has no significant impact on crime rates. We use a fixed effects regression, with state data for 1971-1988, to estimate the impact of seven age groups. Although age structure does affect crime, it is overshadowed by year effects, such that using demographic trends to forecast crime rates is not appropriate. Age groups that most affect crime tend to be somewhat older and less concentrated than the high-arrest ages.

INTRODUCTION

The association between crime and age structure is a major topic in criminology largely because it offers the possibility of forecasting crime trends on the basis of known future demographic trends. Arrest statistics show that the bulk of crime is committed by teenagers and young adults. For example, 46 percent of those arrested in 1988 for indexed crimes were 15

to 24 years old (Federal Bureau of Investigation 1989, at pp. 178-179), and property crime arrest rates at peak ages (in the mid- and late teens) are typically more than ten times the rates for middle-aged adults (see Federal Bureau of Investigation 1988).

This pattern stimulated many attempts to estimate the portion of crime rate changes attributable to age structure changes. Estimates for the 1960s are 40-50 percent (President's Commission on Law Enforcement and Administration of Justice 1967); 40 percent (Sagi and Wellford 1968); 12 percent (Ferdinand 1970); 70 to 80 percent (Chilton and Spilberger 1971); 45 percent (Wellford 1973). Later, Cohen and Land (1987, p. 180) estimated that changes in the 15-29 age group during 1946-84 accounted for 58 percent of the homicide rate trends, and changes in the 15-24 age group accounted for 26 percent of vehicle theft trends. Steffensmeier and Harer (1987, pp. 32-37) estimated that age structure trends were responsible for 40 and 42 percent of the 1980-84 reduction in reported crime and victimizations, respectively. The major impacts were on robbery (36% for reported crime, 57% for victimizations), burglary (31% and 39%), larceny (53% and 42%), and vehicle theft (70% and 100%); they saw little or no impact on homicide, rape, and assault. Making such precise estimates is a rather bold enterprise, but, even though based on different methods and different time periods, the estimates are generally in the same ball park. However, all assume a

dominant, positive relationship between crime rates and the size of high-arrest age groups.

Such estimates naturally led to predictions that crime would decline in the 1980s because demographic forecasts showed that high-arrest age groups would decline (e.g, Steffensmeier and Harer 1987, pp. 38-39; Cohen and Land 1987, p. 180; Cook and Laub 1986, p. 275; Blumstein 1985, p. 38). The ability to predict crime trends on the basis of age structure changes would be tremendously important, but the forecasts proved inaccurate. Crime rates started rising in the mid-1980s and have continued through 1988 (Table 1). The forecasts, however, were accompanied by caveats that other forces might overcome the impact of demographic trends. Cohen and Land (1987, p. 181) noted an upturn in 1985 and gave as one possible reason, "a short-term illegal drugs/crime 'bubble,' which our models are not designed to capture."

This, of course, is one likely explanation; but failure of the predictions invites reexamination of the bases upon which they were made. We will explore whether there actually is an age/crime relationship (for which the evidence is surprisingly weak), whether the high-crime age groups as identified by arrest data are in fact the age groups associated with more crime, and whether prior estimates concerning the magnitude of the age/crime relationship are reasonable.

The age/crime relationship is especially vulnerable because it does not have a firm theoretical foundation.

Hirschi and Gottfredson (1983) contend that it cannot be explained by existing social theory because the latter does not account for the fact that the relationship is largely invariant. Although recent research suggests that the claim of invariability is overstated (e.g., Steffensmeier et al. 1989; Farrington 1986, but see Shavit and Rattner 1988), the fact remains that the age/crime relationship is not backed by established theory. There is no absence of speculative reasons (see summaries in Farrington 1986, pp. 230-235; Gove 1985; Greenberg 1977; Tittle 1988), including the physical ability to accomplish strenuous criminal acts, chemical factors such testosterone levels that might predispose persons to crime, innate recklessness of juveniles, level of moral development, inability to balance immediate gains against long term effects of crime, participation in peer groups consisting of frequent offenders, opportunities for gainful legitimate employment, extent of family ties, and greater legal penalties given adults and repeat offenders. But as Hirschi and Gottfredson (1983, 1985) stress, there is little if any empirical support for such contentions, without which one cannot claim that theory supports the existence of an age/crime relationship. Those attempting to evaluate different theories have admitted little success (Rowe and Tittle 1977; Shavit and Rattner 1989).

The following section will discuss the recent trends in crime rates, showing that they have not undergone the predicted decline in recent years. We then outline objections to relying

on arrest rate statistics to delineate the age/crime relationship: the arrest rate age structure may not reflect the age structure of offenders, and crime might be affected by the age structure of victims as well as that of offenders. Next we survey the large body of research that regresses crime rates on age structure variables; only a small minority find significant relationships. The next topic is the possibility that other factors, including changes in the age/crime curve, might explain why crime rates have departed from demographic trends. Finally, we explore the age/crime relationship through a times series-cross section regression over 1971-1988, the years for which adequate data are available at the state level.

CRIME TRENDS

The basic trends in the 50 states are summarized in Table 1. The percent of population aged 15 to 24 has declined at an increasing rate since 1978, a trend very different from most crime rate measures (but one should keep in mind the frequent problems with crime data). Reported crime increased from 1978 through 1980, dutifully declined through 1984, but then increased in 1985 through 1988. Because the reported crime rates are subject to the criticism that they are influenced by victims' propensity to report crimes, Table 1 also presents an adjusted crime rate calculated as follows: each type of crime (except homicide) is divided by the fraction reported to the police that year, as determined by the National Crime Survey

(Bureau of Justice Statistics 1974-1989), and the adjusted crime index total is the sum of the crime index components so adjusted (plus homicides), divided by population. The trends described above, including recent increases, remain after the adjustments, although the variations are less pronounced.

Arrest rates follow the same general pattern even though some of their variation is due to the fact that jurisdictions reporting arrest data vary substantially from year to year (the arrest rate in Table 1 is the number of arrests divided by the population of the reporting jurisdictions). Finally, victimizations, as found in the National Crime Survey, generally declined from the mid-1970s, as did the percent population 15 to 24, but they changed direction in the past two years.[1] The victimization trend, however, is not easily compared to the crime index trend, largely because it excludes crimes against businesses. In sum, although the statistics are not sufficiently accurate to state that crime has risen substantially in recent years, the evidence is strong that the forecasted decline did not occur.

The trends for the index crime total shown in Table 1 broadly apply to its components. Percentage growth figures

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1. To arrive at the estimates in Table 1, we divide the total of personal and household crimes by population to make the figures comparable to Uniform Crime Report data, in the same manner as Steffensmeier and Harer 1987

were generally positive in the late 1970s through 1980, negative in the early 1980s, and positive from 1985 through 1988 (Table 2). Changes in the adjusted figures for each crime type are less regular (Table 3), due largely to wide fluctuations in reporting rate estimates for individual crimes. Again, the downward trend of the early 1980s appears to have been reversed, but robbery and burglary are possible exceptions. Homicide and vehicle theft clearly did not decline after 1984, as Cohen and Land (1987) predicted. Property crime trends have not conformed with the prediction by Steffensmeier and Harer (1987, p. 39) that they would decline through the 1980s, specifically by roughly 9% between 1984 and 1990.

RELATIONSHIP BETWEEN ARRESTS AND CRIME RATES

The first of numerous reasons why the predictions may have failed is that arrest data, the evidence for the age/crime relationship, may not present an accurate picture of the age groups that most affect crime rates. The use of incorrect age categories can result in very inaccurate estimates of the impact of age structure changes and, thus, inaccurate forecasts crime trends. Table 4 gives the percent change for different age groups, using the age categories for 1971-88 available in U.S. Census Bureau (1986 and 1989). Trends in the high-arrest groups, 15-17 and 18-24, are very different from trends in other groups. The baby boom cohorts, for which birth rates increased steeply from 1945 to 1960, produced rapid growth in

the 25-34 group during the 1970s and in the 35-44 group during the 1980s. Birth rates then dropped through 1974, producing the recent drop in the 15-24 group, but birth rates increased again as the baby boomers became parents, such that the number of teenagers will soon expand. Also, note that the 15-17 age group actually grew in 1986, the result of a little blip in births during 1970 and 1971 (see Blumstein 1985, p. 37). Because trends for age groups vary so much, proper age group identification is necessary before making forecasts based on demographic trends.

Those claiming that arrest rates are associated with crime rates make several intermediate assumptions that may not be justified. To provide a framework for discussing these assumptions, we must define several key concepts. The arrest rate for an age group is the number of arrests of age group members divided by the population of the age group; it is not the percent of persons arrested because some are arrested more than once. The offending rate for an age group is the number of offenses committed by persons in an age group divided by the population of the age group. The crime rate is the number of crimes per capita, and the crime rate for an age group is the number of crimes committed by age group members divided by the population of the group; they differ form the offending rate in that many crimes have more than one offender. The high-impact ages are age groups that are positively associated with crime rates; that is, crime increases when the size of the high-

impact age groups increase. The high-crime rate ages can differ from the high-impact ages if age structure affects crime rates through ages of victims as well as ages of offenders. Age structure is the percent of persons in different age groups; the arrest age structure is the arrest rates for the various ages, and offending age structure, crime age structure, and high-impact age structure have corresponding meanings.

The age/crime relationship is the contention that changes in age group size affect crime rates. As a practical matter, those advancing an age/crime relationship assume that the arrest rate age structure corresponds to the offending rate age structure, that the offending rate age structure corresponds to the crime rate age structure, and that the crime rate age structure corresponds to the high-impact age structure. This is a substantial string of assumptions, and one can question the age/crime relationship at every juncture.

Arrest and Offending Age Structures.[2]

Almost all doubts expressed about the use of arrest age structure data pertain only the first step, the relationship between arrest and offending age structures. Most researchers using arrest age structure data acknowledge that they are assuming it is similar to the offending rate age structure (e.g., Wellford 1973, p. 69; Steffensmeier and Harer 1987, p. 45). Only small percentages of crimes, especially property crimes, are cleared by arrest, and those arrested are far from a random sample of offenders, creating at least the possibility of substantial bias.

The problem mentioned most often (e.g., Wilson and Herrnstein 1985, at 132) is that police may apprehend younger offenders more often then older offenders. There are several reasons for this suspicion. First, the older offenders may be more skilled at escaping apprehension because they are more professional (Greenberg & Kessler 1982, p. 774; Blumstein and

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2. An initial problem with using arrest data as evidence of offending age structure is that they are among the least accurate criminal justice data. The jurisdictions reporting arrests vary from year to year. Sherman and Glick (1984), in particular, have criticized the usefulness of arrest data on the grounds that jurisdictions apply greatly varying definitions and data gathering procedures, and juvenile arrest data are probably the worst in this regard (Klein, Rosenweig, and Bates 1975).

Cohen 1987, p. 986). Talent in at least some criminal activity may well be learned in the same manner as other activities such as sports or trades (Deutsch, Hakim and Spiegel 1990; Friedman, Hakim, and Spiegel 1989), a possibility consistent with criticism of prisons as "crime schools." In one area that will prove important later, Steffensmeier and Harer (1987, p. 45) note objections that vehicle theft arrest age structure may be younger than the offender age structure because more juveniles are likely to be arrested than professional auto thieves.

Second, there may be a natural selection process, whereby offenders more skilled at escaping apprehension are more likely to continue criminal activity because, for example, they are not deterred or incapacitated by incarceration.

Third, younger offenders are probably more prone to commit high risk crime (Steffensmeier 1989, p. 807; Farrington 1986, pp. 231-232). In fact, one theory why teenagers are more prone to crime is that they are thrill seekers (Baldwin 1985), which implies entering into more risky crimes. In a survey of 49 prison inmates, teenagers tend to give reasons for committing crime that pertain to "thrills, attention or status," whereas older criminals tend to give economic reasons (Petersilia, Greenwood and Lavin 1978, at 111).

On the other hand, offending rates for young adolescents may be higher than arrest data indicate because police may more often exercise their discretion not to arrest. Observation research indicates that police arrest only a small fraction of

the suspects caught, although arrests are much more frequent when major crimes are involved (Black and Reiss 1970; Ludman, Sykes, and Clark 1978). Shavit and Rattner (1988, p. 1461) suggest that Israeli police reluctance to arrest children accounts for the sharp rise in arrest rates for those 12 to 14 years old. Police may be more reluctant to arrest juveniles than adults because the former are less likely to receive sanctions and because citizens may be less likely to urge arrests of children (police observation research found that most police contact with offenders was in response to citizen complaints and that arrests were less frequent when complainants did not urge arrest).

There is little useable information that directly supports the correspondence between arrest and offending age structure, primarily because nearly all the evidence available is itself based on arrests. Research on crime career patterns suggests that crime rates vary with age in a manner similar to that shown by arrest statistics. Common conclusions are that (1) the volume of crime committed by cohort members peak in the late teens for property crimes and in the twenties for violent crimes, (2) the number of persons in a cohort that continue to commit crimes declines sharply after the peak, (3) most committing crimes in their twenties and thereafter were first arrested early in their teens, but a sizeable minority were arrested for the first time later, (4) the rate of offending - the average number of offenses committed by those who have

continued to commit crimes - is similar for teenagers and young adults, and (5) as offenders age they tend to shift from property to violent crime (see Blumstein et al. 1986; Cline 1980; Farrington 1979 and 1986; Kempf 1988; Petersilia 1980; Stattin, Magnusson, and Reichel 1989). Because these findings are based on arrest information, however, they are relevant to questions about the relationship of age structure to crime rates only to the extent that arrest rate and crime rate age structures are similar.

Arguments that they are similar are based on studies of self-reported crime by persons of different ages and on victims' accounts of age of offenders (see especially, Wilson and Herrnstein 1985, pp. 132-136). This evidence, however, is far from conclusive because it, like the arrest rate figures, encounters likely selection bias problems. Four self-reported crime studies are relevant here. The National Youth Survey, according to reanalysis by Cohen (1986, pp. 347-349; Blumstein et al. 1986, p. 69), found that crime rates for indexed offenses are quite flat between 13 and 20 except for a peak 15, attributable to an unusually large number of robberies in one sample year. This is consistent with arrest records, although according to Blumstein et al. (1986, pp. 41-42) it suggests that self-reported crime rates peak at a slightly lower age than arrests indicate (Blumstein et al. 1986, pp. 41-42). However, because those over 20 are not included, the National Youth Survey cannot be used to support the key feature of

arrest rate data, that crime rates drop off for young adults.

A second youth survey, the Monitoring the Future panel study, conducts yearly interviews with high school seniors and with follow-up samples for several years thereafter. By the age of 23, self-reported crime trails off to half the rate of 17 year-olds, a pattern similar to that for arrest rates (Osgood et al. 1989). But this survey almost surely undersamples frequent and persistent offenders: it excludes persons who left school by April of their senior year, and it excludes those who could not be located for follow-up interviews (Osgood et al. 1989, p. 394).

Another important study compared arrest records and self-reported arrests rates for California prison inmates, concluding that the chances of arrest per crime committed did not change appreciably over age (Peterson, Gracker and Polich 1980). Also, older prisoners evidenced no greater sophistication in their crime procedures, suggesting that offenders do not accumulate skill (but, when crimes are conducted with more skill, e.g., with advance planning, the chances of apprehension are reduced). These findings, however, are not persuasive evidence for similarity of arrest rate and crime rate age structures because the sample consisted of offenders who had been apprehended and convicted, and presumably less skilled at escaping detection.

To escape selection bias, individual level studies must be based on broad samples of citizens and must use sources of

information other than arrest, such as self-reported crime.[3] The one such study cited is a 1972 survey of persons 15 or older in Iowa, New Jersey, and Oregon (Rowe and Tittle 1977). Respondents were asked whether they would steal something worth about $50 in a situation where they had an extremely strong desire or need to do so; 21 percent of the 15-24 age group, and 14 percent of the 25-44 age group, answered affirmatively.[4] This suggests much more criminality by the older group, relative to the younger group, than corresponding arrest data: larceny arrest rates for the two age groups in 1972 were 9.4 and 2.3 (Federal Bureau of Investigation 1973). On the other hand, the age structure for "physically harming someone on purpose" is similar to the assault arrest age structure.

A separate category of evidence used to support the correspondence between arrest and offending age structures is victims' accounts of offenders' ages. Hindelang (1981) concluded that the robbery arrest-rate age structure is very similar to that for age structure in the victims' reports. But the relationship is actually not that clear. An initial

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3. Even this design is probably not feasible because of the vagaries of self-reported crime and the fact that a very small portion of the sample would be frequent offenders of major crimes.

4. A similar pattern was obtained, but not reported, when respondents were asked whether they had stolen property.

problem is that victimization data are available only for crimes in which offenders permitted victims to view them; hence, information is available only for some types of crimes, leading to a selection bias against offenders careful to escape identification. Also, the correspondence between victims' reports and arrest rates is not true of all crimes. Table 5 gives the percent of offenders whom victims believed to be 20 or younger (Bureau of Justice Statistics 1988). We have adjusted the published data in two respects. First, approximately a third of the multiple-offender crimes are classified as "mixed ages" - that is, the offenders fall into different age groups (the age breakdown is 0-12, 13-20, 21-29, and 30 or over). We divided the "mixed ages" cases equally between the over-20 and 20-or-less groups, resulting in less extreme values for the latter (this is preferable to Hindelang's unrealistic practice of assigning all mixed aged offenders to the older age group, which would produce a figure of 28.7 percent 20 years or less for robbery). Second, we calculated a weighted average to combine single- and multiple-offender crime types, multiplying the percent 20 or younger for each type by the estimated number of crimes in the type, and then dividing the sum of the two figures by the total number of estimated crimes.

The victims' responses for robbery and rape suggest a slightly higher offender age than arrest data, but the differences are minor given the uncertainties of victims'

estimates and the data adjustments required. There is a large difference for assault, however; victims' accounts give almost half again as many offenders under 21 as arrest data. Youths committing assault may be more likely than adults to escape arrest.

Offending Age Structure and Crime Age Structure.

Many crimes are committed by groups of offenders, and to the extent that juveniles "work" in groups more often than adults, the offending age structure is younger than the crime age structure. Table 5 provides some evidence that this occurs. According to victims' reports, offenders in multiple offender crimes are far more likely to be 20 or under than single offenders. This is particularly important for robberies because more than 40 percent of the reported victimizations are multiple-offender crimes (see Table 5).

Crime Age Structure and High-Impact Age Structure.

Nearly all those researching the age/crime relationship assume that age structure affects crime rates only through the supply of potential offenders. Cohen and Land (1987) argue, and we agree, that one must consider both offenders and victims. Estimates of the impact of age structure based on offenders age structure, ignoring victims' age structure, are likely to be incomplete.

Recent research on causes of crime has stressed the role

of opportunity factors, such as households likely to be abandoned during the day (e.g., Cohen and Felson 1979) and the possible positive impact of economic growth on crime because it increases the number of lucrative targets (Cook and Zarkin 1985; Cantor and Land 1985). Land and Cohen (1987, pp. 174-175,180) extended crime-opportunity theory to the crime/age relationship, but they assume that because the peak arrest and peak victimization age groups are similar, the affects of offender and victim supply factors are indistinguishable. Crime-opportunity theory, however, suggests that older age groups are at least as important because they present more tempting targets. Cohen and Felson (1979) and Cohen and Land (1987) found that the crime rates are strongly associated with the residential population density ratio, which is the proportion of households that are not husband-wife households or that have female labor force participants. These two groups are especially large in the young and middle-aged adult groups, ages well above the high-arrest ages for property crime. Also, the theoretical reasons why economic growth might stimulate crime apply to age structure: persons with rising or high incomes can be expected to purchase more possessions, suitable objects for crime. Such person, again, are far more likely to be adults than the high-arrest age groups. Finally, older persons may be more attractive targets for violent crimes because they are less able to defend themselves. The victimization data also support the importance of opportunity

factors. Although peak age for arrest and victimization rates are similar, the age structure curves are very different. Arrest rates for property crime are much more concentrated at peak age groups, and there is relatively more victimization above 25 years (Bureau of Justice Statistics 1989, pp. 17,37). The pattern is reversed, however, for assaults.

Neither crime-opportunity theory nor the victimization data pinpoint any particular age groups that might have the greatest impacts as victims; there is reason for including young adults (e.g., as initial accumulators of possessions) and middle-aged or older adults (e.g., as the most affluent). No matter what age groups are important, it should be stressed, when one finds that a specific age group variable is associated with crime rates, one cannot easily separate the impact as victim from that as offender.

REGRESSION STUDIES

A second strategy for estimating the impact of age structure on crime is regression analysis, with reported crime rates as the dependent variable and percent in a high-crime age group as an independent variable. We have located 65 such studies; 50 are listed in Appendix A (26 cross section and 25 time series studies, with one duplication), and the remainder (all cross section studies involving homicide) are found in Land, McCall, and Cohen (1990, pp. 927-932). A fully comprehensive search is not feasible, and we undoubtedly missed

some research. Almost all 65 enter age group variables as control variables only; most are deterrence studies that explore, for example, the impact of the death penalty or police expenditures on crime rates.

Although regression analysis escapes the problems described above to the extent that variables are not constructed with arrest data, as a practical matter the researchers rely on such data to select the age groups entered as independent variables; if arrest age structure differs from the high-impact age structure, the regressions may not include the age groups with the greatest impact. Moreover, the age structures variables are always incomplete; the age groups are broad, usually ten years or more, and researchers rarely enter more than one age group, perhaps to avoid multicollinearity and loss of degrees of freedom.

Table 6 summarizes the results obtained in the 65 studies. Although the research uses a wide variety of designs and age measures, the overwhelming impression is that the age/crime relationship is far from established. If one counts each analysis of a separate crime category as a separate study, only 25 percent found significant positive coefficients for the age structure variables in any analysis (only 10 percent found significant results in all or at least three quarters of the analyses). Among those not finding significant positive relationships, the coefficients are as likely to be negative as positive. There is no indication that results depend on the

age variables selected, and there is no apparent difference between studies using percent of all population in high-crime ages, percent of males, or percent of nonwhites. Similarly, we see no clear sign that the results differ between types of crimes. The percent positive findings vary from 10 percent for rape to 37 percent for homicide, not a large range given the rough nature of the tabulation.

The outcome is closely associated with research design: time series studies far more often produce significant positive coefficients than cross section studies. In fact, the results in the latter seem random, with as many negative as positive coefficients and as many significant negative as significant positive coefficients (Appendix A). A likely reason for this pattern is that age structure differs little between jurisdictions. We tried to regress crime index categories on the percent population 15-17 and, in separate regressions, percent 15-24, using state data for each year from 1971 to 1988. Collinearity diagnostics (SAS Institute 1985) showed extreme collinearity, with condition indices well above 100, in all regressions. In other words, the age structure variables are collinear with the intercept, which means that they do not have sufficient cross-state variation to produce reliable results. We have not tested whether cross section regressions using other units encounter the same problem, but they are no more likely than state studies to produce significant positive results (Appendix A). At least in this context, therefore, the

lack of variation in age structure variables is an effective answer to the contentions by Gottfredson and Hirschi (1987 and 1988; Hirschi & Gottfredson 1983) that cross-section analysis is preferable to time-series analysis.

The time series studies in Appendix A also encounter major problems. The time units are usually much fewer than considered adequate for time series analysis; only eight of the 25 in Appendix A meet the usual recommendation of 50 time units (e.g., Cook and Campbell 1979, p. 228). This alone may explain the uneven results; with the partial exception of Wolpin (1978) all eight found significant relationships. A second concern is the common vulnerability of time series analysis to spurious results due to common trends. Most studies concentrated on the period from the mid-1950s through the mid-1970s when both crime rates and teenage population rose fairly steadily. Nevertheless, we see little evidence of a common trend problem. Appendix A indicates whether the researchers attempted to control for trend effects, that is enter counters, use first differenced variables, or use a Granger test. About 60 percent made such efforts, and they are just as likely to find significant results as the remaining studies. Also, we replicated Cohen and Land (1987), which is one of the few studies entering age structure as more than a control variable and which concluded that age has a very significant impact, and we found that the impact remains after adding a counter or first differencing the variables.

In all, therefore, Table 6 gives some moderate support for an age/crime relationship in spite of the overwhelming weight of results otherwise. One can discount the cross section research. Most time series studies did not have sufficient degrees of freedom for proper analysis, but those that did generally found strong age/crime relationships. It is illustrative that Chiricos (1987), after compiling studies exploring the impact of unemployment on crime and finding a pattern similar to that in Table 6, concluded that one could not dismiss the possibility of an impact and that future research was necessary. That is also the safest conclusion from Appendix A.

OTHER EXPLANATIONS

The fact that crime rates have not fallen in recent years does not, of course, disprove the age/crime relationship because there are numerous other likely reasons for the trends. Perhaps the most likely are changes in important factors that affect crime rates but are unrelated to age structure, factors traditionally called "time effects." A major candidate is drugs. Drug use is high among arrested criminals, but there is little evidence that it increased greatly in recent years or that drug use has a major impact on the volume of indexed crimes. One can advance numerous other candidates, such as greater inequality between the upper and lower classes and weaker family structure, but again we are not aware of any hard

evidence that such factors are behind the crime growth in recent years.

Another possible explanation for the failure of crime rates to decline in recent years is that the nature of the age/crime relationship has changed due to cohort effects or a change in the age/crime curve. One cannot logically distinguish these two from the direct effect of age structure and the operation of time effects without making a priori (unprovable) assumptions about relationships between two or more (Farrington 1986, pp. 203-207; Greenberg and Larkin 1985). The task for the present research, however, is only to distinguish the direct impact of age group size from the other age-structure effects, which is feasible.

Cohort effects are changes in crime rates for a birth cohort that persist for cohort members over some time. This effect may show up as a bubble of higher crime rates for the cohort that does not follow other cohort groups and that does not permanently change the shape of the age/crime curve. But in the short term, this is indistinguishable from a change in the crime age structure.

Changes in the crime age structure, or relative crime rates of different ages, could account for recent trends. The only available data sufficient for a detailed description of the structure is arrest data, which is subject to the problems described earlier. These data show that the arrest age structure differs between violent and property crimes, but is

similar within each category (see especially Steffensmeier et al. 1989). Burglary, larceny, vehicle theft, and robbery (which we classify as a property crime) peak at lower ages, with a more concentrated peak, than homicide, rape, and assault. Table 7 gives 1970, 1980, and 1988 arrest age peak rates, which are defined as the years having arrest rates within 95 percent of the highest for that crime (the arrest rate for the single peak age is not used because its movements mean little when several ages have arrest rates near the peak). These ages for property crimes range between 15 and 19, and the arrest rates at peak ages are comparatively high, four to eight times the average arrest rate for all ages. The peak ages for violent crimes occur later, 18 to 24 years old, and the peaks are less pronounced. Table 8 illustrates the same pattern in a different manner, giving the years for which arrest rates are above average, twice above average, and four times above average. Property crimes have narrower ranges for above average arrests then violent crimes, and they are much more likely to have age groups with very high arrest rates.

For our purposes, the important issue is whether crime age structure has changed appreciably in recent years. Have the peak crime rate years changed or have crime rates in peak years increased or declined in relation to crime rates for other age groups? Table 4 suggests that the failure of crime rates to decline in recent years might be explained if crime rates grew for the 25-44 groups, which gained population, either because

the peak moved to higher ages because the age structure became less concentrated.

Changes over the log term have been in he opposite direction, towards younger peak ages and towards more concentration. Blumstein (1985; Blumstein, Cohen, and Farrington 1988) documented these changes from 1965 to 1980, and Steffensmeier et al. (1989) documented them from 1940 to 1960 and 1980, but both cautioned that the changes might be due to changes in police practices concerning the recording of juvenile arrests. This trend, in any event, has abated. The peak ages for most crimes changed little from 1970 to 1988. Homicide is the main exception, with a decline of approximately two years for the peak and seven years for the oldest age group with above average arrest rates (Tables 7 and 8). On the other hand, burglary and larceny evidence increases of roughly one year in the peak ages and sizeable increases for oldest years with high arrest rates. A corresponding trend is the reduction in concentration around the peaks for rape and all property crimes. The peak age arrest ratios declined (Table 7), the ages with above average arrest rates expanded at the upper end (Table 8), and the range of years with arrest rates four times averaged contracted for all five crimes, except vehicle theft (Table 8). Overall, however, the changes in arrest age structure are slight in relation to the magnitude of the demographic trends, and they are far too small to account for

more than a minor portion of recent crime trends.[5] Also, the changes are well within a reasonable margin of error that one should apply to data as questionable as arrest data.

Several other studies also suggest that there has been little or no change in recent years. Cook and Laub (1986) found that youth crime rates, as measured by arrests of persons 13 to 17 years old, changed very little between 1971 and 1983, although they did increase 30 percent from 1966 and 1971. Osgood et al. (1989), using self-reported crime by high school seniors, found little change between 1975 and 1985, except that assaults increased moderately and shoplifting declined. More indirectly, Cohen and Land (1987) found that there was no substantial change in the relationship between either homicide or motor vehicle theft and percent population in high-arrest age groups after the latter began to decline in the late 1970s. Finally, recent research indicates that the reduction in size of the high-crime age groups has at most a modest impact on cohort crime rates (e.g., Steffensmeier, Streifel, and Harer 1987; O'Brien 1989).

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5. Tables 7 and 8 also provide some modest support for the controversial claim that the crime age structure is invariant over time (Hirschi and Gottfredson 1983), although we disagree with the suggestion that the age structure is similar for different crimes.

APPROACH

We have argued that the evidence for the age/crime relationship is not overwhelming, largely because the arrest rate age structure may not correspond to the high offending rate age structure. Theoretical arguments against correspondence abound, but we have found no real evidence other than the general lack of significant results in the regression studies, which might be due to methodological problems.

We apply a procedure, the pooled time-series cross-section regression, that can address the issue far more effectively than research designs used in the past, especially because it can isolate the impact of age structure from other trends. The pooled design combines data from each state over 18 years, 1971-88 (the years for which data are available). This is an econometric design occasionally advocated (e.g., Berk et al. 1979; Lempert 1966; Campbell and Stanley 1966, pp. 55-57; Cook and Campbell 1979, pp. 214-218; Stimson 1985) but seldom used outside economics. The most common form of analysis, which we use here, is the fixed effects model, or analysis of covariance (Mundlak 1978; Pindyck and Rubinfeld 1981; Hsiao 1986). This includes a dummy variable for each year in the analysis (except the first) to capture factors unique to individual years.[6] The

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6. The fixed effects model also calls for similar dummies for each state, but in the present analysis they are canceled out when variables are first differenced. State effects are

variables are first differences of legs, a common procedure (e.g. Cantor and Land 1985; Devine, Sheley, and Smith 1988), which is equivalent to using percent change variables. The benefits of logarithms are that they limit the impact of outliers and that the coefficients are elasticities. There are numerous reasons for first differencing. It transforms the pooled analysis into a time series only. It eliminates the extreme multicollinearity problems encountered by entering numerous age groups in an ordinary regression. It detrends the data and insures stationarity. In this case, the data are not stationary - the variance increases with time - and a regular regression would produce results that are difficult, if not impossible, to interpret (Engle and Granger 1987). First differencing, however, overcorrects for nonstationarity, and the standard procedure is to enter an error correction term, the lagged residual of a regression without first differences (Engle and Granger 1987).[7]

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typically very large in crime studies (state crime level averages differ greatly), and a pooled level without state dummies or first differenced variables (e.g., Peterson and Bailey 1988) is subject to extreme bias.

7. The initial regression with levels included state dummies as well as year dummies. Introduction of the error correction term did not greatly effect the results; it almost always slightly increased the size and t-ratio of the significant

Finally, first differencing limits, but does not cure, heteroscedasticity and autocorrelation problems. We encountered moderate heteroscedasticity because crime rate variation is greater in small states, and we dealt with it by using a weighted regression, weighting by the square root of population. The extent of autocorrelation is seen in the Durbin-Watson statistics in Table 9. Several are within the grey range of 1.57 to 1.78, in which one can neither reject the presence of autocorrelation nor assume its absence.

Specifically, the form of the fixed effects model is as follows:

$$\Delta \ln Y_{it} = a + b_1 \Delta \ln X_{1it} + b_2 \Delta \ln X_{2it} + \ldots + b_N \Delta \ln X_{Nit} + c_2 Z_{i2} + c_3 Z_{i3} + \ldots + c_T Z_{iT} + e_{it}$$

where Y_{it} is the crime rate in state i for year t, and X_{Nit} is the percent of population in the age group N in state i for year t. Also, $Z_{it} = 1$ for the t'th year, $t = 2, \ldots T$; otherwise $Z_{it} = 0$.

This procedure has numerous advantages over earlier research on age trends. The sample size is far larger, permitting more precise estimates and also permitting us to enter many different age structures as independent variables without serious loss in degrees of freedom. As discussed above, most time-series studies regressing crime on age structure have insufficient sample sizes, and almost none enter more than one age structure variable. Second, the year dummies control for factors that affect crime but that cannot be

entered as separate variables. They absorb, for example, the impact of nationwide changes in victims' reporting practices and in deterrence factors such as imprisonment and arrest rates. They also control for any nationwide cohort effect or any nationwide change in the shape of the age/crime curve (but, of course, they cannot distinguish between the two). The year dummies do not, however, control for changes in these or other factors that are unique to individual states. Third, the fixed effects model relaxes the assumption made in cross section or time series analysis that the intercept is the same for each observation, although it does share with these procedures the assumption that coefficients do not vary.

DESCRIPTION OF VARIABLES

Crime Rates

The data cover 1971 through 1988, the years in which state data are available. The dependent variables, state crime rates, are crime index totals and the seven components, each divided by 100,000 state population.[8] The data are from

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8. Some researchers use population figures that exclude young children, for example persons under 10, when constructing crime rates. In the present analysis, this would make no difference because the independent variables, percent in various age groups, would be divided by the same population variable. We note that using population to construct ratio variables does not threaten to

Federal Bureau of Investigation (1972-1989), except that the 1971 larceny data are from unpublished statistics supplied by the Bureau (larceny data before 1971 are not comparable to later data because they exclude thefts involving property worth $50 or less). The crime data are the adjusted statistics published in the succeeding year Crime Reports (i.e., 1980 data were taken from the 1981 Crime Report, and so on).

The quality of crime data is always a major concern. Reported crime is the best data at the state level, and it is widely believed that for the period covered here, that is after 1970, the data are reasonably adequate (e.g., Cohen and Land 1984; Gove, Hughes, and Geerken 1985; Myers 1980). Nevertheless, we took several steps to mitigate data quality problems. As discussed earlier, the year dummies control for nation-wide changes in propensity of citizens to report crime (see Table 3), the use of logged variables limits the impact of outliers, and the error correction term corrects for data glitches. We deleted Illinois because the Chicago police seriously undercounted crime before 1984 (Federal Bureau of Investigation 1986, pp. 4-5). Finally, we used influence analysis (SAS Institute 1985, pp. 676; Belsly, Kuh, and Welsch 1980) to uncover observations that may unduly affect the result. Besides Illinois, only one significant problem

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cause spurious relationships because the data are accurate and change little from year to year.

appeared, South Dakota for the homicide regression.[9]

Age Structure Variables

The age structure variables are the percent population in specific age groups. Data are available for the age groups listed in Table 4, but the 0-5 and 65-and-over groups are not entered to prevent multicollinearity. State-by-year data are not available for age groups broken down by sex or race. The data were obtained from U.S. Census Bureau (1986 and 1989), and they are estimates as of July 1 each year.[10] Consistent age category data are published for ages 0-4, 5-14, and every ten years thereafter, ending with ages 65 up. Fortuitously, we were able to break the 15-24 group into 15-17 and 18-24; before 1980 this was accomplished by using published data for ages 18-and-over. Except for 1980, the data are Census Bureau estimates only; figures for the 1980s are regularly revised,

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9. Deleting Illinois had little effect on the results, largely because the error correction term absorbed most of the large irregularities in the data. If South Dakota is included in the murder analysis, the coefficient for the 25-34 age group becomes larger with a higher t-ratio.

10. The published 1980 data are from the April 1 census, and we adjusted them by adding one-third the difference between the 1980 and 1979 statistics.

and the final version will not be available until well after the 1990 Census.

We do not enter additional control variables, other than the error correction term and year dummies, because of simultaneity problems. Factors that, according to criminology theory, might affect crime, such as arrest rates, imprisonment rates, prison population, and economic conditions, may also be affected by crime rates (e.g., Blumstein, Cohen, and Nagin 1978; McGuire and Sheehan 1983), and their use as independent variables would not be appropriate. We do not attempt simultaneous equations because adequate identifying restrictions are scarce (Fisher and Nagin 1978).

RESULTS AND DISCUSSION

On whole, the eight basic regressions (Table 9) support the general assumption that age structure effects crime. The overall pattern is one of large coefficients, but in several instances with low t-ratios; hence, we use the .10 significance level rather than the standard .05 level. At least two age groups are significant in all but the homicide regression. Because the age variables are logged, the coefficients are elasticities, or the percent change in crime rates for each one percent change in the percent population in the particular age group. The typical significant coefficient is between one-half and one, indicating that changes in age structure (see Table 4) produce somewhat similar changes in crime rates. Surprisingly,

in view of prior research (see Table 6) age structure has the greatest impact on rape, in terms of significance levels and coefficient size. Next come robbery, larceny, and burglary with large and highly significant coefficients. Homicide, assault, and vehicle theft have sizeable coefficients for one or more age groups, but given the marginal significance levels, we cannot definitely state that they are affected by age structure.

Identifying High Crime Age Groups.

The next issue is whether the arrest age structure is similar to the high impact age structure. There is no adequate statistical test for judging such a comparison with the data on hand, especially because the age variables in Table 9 have wider age spreads than for arrest statistics. Therefore, we provide a rough visual comparison in Table 10. The top line for each crime gives the high impact age groups, the age groups with significant positive coefficients in Table 9. The remaining lines display the arrest rate age structure. We cannot determine a priori what level of arrest rates translates best to the highest impact on crime rates. The minimum level is above average arrest rates, as given in Table 10, and we also present age spreads for arrest rates twice and four times average. The high impact age groups always overlap years with arrest rates above average, but almost half the latter are not high impact ages. The fit is closer for ages with arrest rates

twice average: they encompass all but three of the high impact age groups, but they are not matched by high impact groups in nine instances. Arrest rates four times average (as well as those three times average, not reported here) match poorly. We concentrate, therefore, on the middle group, with twice average arrest rates, calling it the "high arrest" group in the following discussion, although the general conclusions apply to all the arrest rate levels.

The general impression from Table 10 is a fairly close correspondence between high impact and high arrest age structures, although close inspection reveals a few important differences. The high impact groups tend to be older: they do not include the lowest high arrest groups for all crimes except larceny and vehicle theft, and the oldest high impact age is above the oldest high arrest age for rape, burglary, and vehicle theft.

On the other hand, arrest rate statistics may underestimate the amount of larceny committed by children, even though it has the lowest arrest rate structure of all indexed crimes. The 5-14 age group is the most important in Table 9, even though one would expect very little crime by the younger half of the group. In contrast, arrest rates for those below 12 are negligible, and the rates for children 13 and 14 are approximately a fourth less than the peak rates (Federal Bureau of Investigation 1989, p. 178). Hence, there is some evidence for larceny, but not other crimes, that police are less likely

to arrest children than adolescents or adults.

Arrest data are more concentration than the results in Table 9. The existence of only one high impact age group for homicide and two for assault does not suggest more concentration because the results are only barely significant. The most extreme difference is for vehicle theft. Table 9 shows very little concentration, with four age groups positively related to crime at low significance levels and a significant negative coefficient for the 35-44 age group. This age structure contrasts sharply with the arrest age structure, which shows more concentration around the peak ages (14 to 18) than any other crime type (Table 7 and 8).

A peculiar feature that reduces the degree of concentration for property crimes is the bimodal peak ages for property crimes in Table 9. The 18-24 group has less impact on robbery and burglary rates than the 15-17 or 25-34 groups. Less pronounced dips occur for larceny and vehicle theft at 15 to 17.[11]

It is difficult to determine whether high-impact age structure is older and less concentrated than the arrest age structure because arrest rates are biased in favor of young

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11. Shavit and Rattner (1989, pp. 1460-61) found a similar bimodal pattern in Israel, with the dip at 17 to 20, but they suggest the cause may be military conscription, a factor not likely to have a major impact on crime in this country.

offenders or because, as suggested by crime-opportunity theory, the crime rates are affected by older age groups as victims. The great impact of older age groups on rape could mean that police are more likely to catch juvenile rapists or that women 18 to 44 are the most suitable rape victims. The flat distribution for high impact ages in vehicle theft could mean that older vehicle thieves are more professional and, thus, escape arrest (Steffensmeier and Harer 1987, p. 45), or it could mean that older persons are more likely to own automobiles that are worth stealing. (The negative impact of persons 35-44 years old is probably an anomaly, but if pressed one could explain it by contending that they are more likely to protect their automobiles.) The high vehicle theft arrest rates for teenagers too young to own cars, however, must be due to the fact that they get caught more often; one assumes that joy riders are less likely to avoid the police than auto thieves motivated by monetary gain.

The bimodal pattern for property crime is consistent with crime-opportunity theory: the lower peak ages represent the peak offending ages, and the upper peak ages represent the conjunction of the upper end of high offending ages and the lower end of age groups that provide the more attractive targets. The early adult years are when persons tend to begin accumulating possessions and owning homes. The opportunity theory is also supported by the positive coefficient for the 55 the 64 age group for assault (presumably older persons

represent relatively defenseless targets) and the 45 to 54 age group for larceny and vehicle theft (presumably these persons accumulate more valuable automobiles and other possessions). In the homicide, rape, and robbery regressions the coefficients for the older age groups are also positive, although not significant. Burglary is the only counter example, with a moderate negative coefficient for 55 to 64 years, perhaps representing movement from homes to apartments.

There is, oddly enough, some correspondence between the results obtained in Table 9 and the body of research summarized in Appendix A and Table 6. None of the regressions in Table 9 except for larceny and total crime (which is mostly larceny) have significant coefficients for both the 15-17 and 18-24 age groups. Regressions run with just the 15-24 age group, which best approximates the typical analysis in Appendix A although widely varying ages are used, found that this variable is far from significant except for robbery (coef. = 1.01, t = 1.96) and larceny (coef. = .64, t = 2.62). The general lack of significance in prior research may be the result of entering inappropriate age categories.

In all, the results in Table 9 are not inconsistent with arrest rate data. The high impact ages are broadly similar to the high arrest ages, and the differences can be interpreted as products of crime-opportunity factors. Much of the crime career research is based on the assumption that arrest-rate age structure is similar to crime-rate age structure (e.g., Cohen

1984, p. 58), and the results here do not undermine that effort, although we do not supply evidence that the two age structures correspond. The main conclusions from Table 9 are further support for the crime opportunity theory and the fact that arrest-rate age structure should not be used to estimate the portion of crime changes due to age-structure changes or to forecast time trends.

Overall Impact of Age Structure on Crime

There is a more fundamental reason why age structure data cannot be used to forecast crime: its impact is masked by that of other trends. Table 11 compares the percent change in average state crime rates to the impact of demographic changes estimated from the elasticities (coefficients) in Table 9.[12] The two do not match, either for the whole 1971-88 period covered by this study, or for the 1978-88 period when the high arrest age groups declined. The sole exception, rape, may be only a chance occurrence, but note that rape is affected by age structure changes far more than other crimes (Table 9).

The reasons why the estimated and actual changes in Table 11 do not match can be seen from the extreme importance of error correction terms and year dummies in Table 9. The former

12. Table 11 is far from an exact estimate of the effects of age-structure changes because confidence intervals for many coefficients in Table 9 are large.

that period.

In practice, there is no good way to measure the relative impact of the age variables and year dummies. Certainly both have sizeable impacts. The elasticities of the significant age variables are quite large, and their combined impacts would cause, if other factors were not involved, noticeable changes in crime rates. On the other hand, the average yearly percent changes caused by the year effects (Table 9) are similar in size to the yearly change in crime rates (Table 2). A rough comparison of their importance can be seen in Table 11, which gives the percent changes in crime rates estimated from the coefficients in Table 9. The estimated impacts of year effects are typically larger than those for age structure variables, especially the vary large growth estimates for property crime, but the actual growth is usually closer to the estimates based on age structure than to those based on year effects, although it is seldom similar to either.

The frequent attempts to estimate the portion of crime growth or decline that can be attributed to age structure change are misdirected. Even though age structure does affect crime rates, the impact is so overshadowed by other, countervailing factors that such estimates can have little meaning. Also, by implication, we disagree with the contention that crime rate statistics are more suitable if adjusted for age structure (Steffensmeier and Harer 1987, pp. 28-29), because it would give age structure a primacy that it does not

deserve and because the arrest rate statistics may not present a sufficiently accurate picture of the age/crime relationship. Finally, the importance of the year effects and the uncertainty concerning which age groups are high impact groups strongly indicate that forecasts of crime trends on the basis of age structure are highly likely to prove inaccurate and should not be used as a basis for policy.

Periodicity

The year effects for the different crimes show remarkably similar trends (Table 9). They produced unusually large growth in crime during 1973-75, 1979-80, and 1985-88 (Table 9).[13] This periodicity is similar to the four-year cycle noticed by Wellford (1973; Sagi and Wellford 1968), with high crime growth in 1960, 1964, and 1968; although the more recent trends suggest a six-year cycle. The major disadvantage of the fixed effects model is that it does not identify the variables behind

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13. This pattern is consistent with self-reported illegal behavior of 17-year-olds from 1975 to 1985 (Osgood et al. 1989:400-401), and it is consistent with arrest rates and victimization trends with the exception of 1980, as seen in Table 1 (victimization rates that year may be artificially low because the National Crime Survey greatly increase the portion of telephone interviews, and victims may be more likely to report crimes during in-person interviews. Steffensmeier & Harer 1987, p. 36).

the year dummies (Pindyck and Rubinfeld 1981, p. 255). Like Wellford (1973)[14] we cannot identify the factors responsible for these year effects, but we can say that they have a very large impact on crime rates, even after controlling for age structure. Without a firm basis in theory, moreover, we cannot give much weight to evidence of periodicity, but many important discoveries began by unexplained regularities that eventually stimulated major theoretical advances (examples that come to mind are continental drift and the periodic table). A good test for the periodicity hypothesis, of course, is whether crime rates decline in the next few years.

SUMMARY

In recent years we have not seen the forecasted decline in crime rates even though the portion of population in high crime age groups declined. The forecasts were based on the assumption that ages with high arrest rates are actually the ages that are associate with higher crime rates, and we argue that the assumption is suspect because, for example, police may

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14. Sagi and Wellford (1968:34) suggest that the pattern results from changes in degree to which crimes are reported and recorded. Changes in citizen reporting practices (U.S. Bureau of Justice Statistics 1974-87), however, do not conform with the periodicity here; the major change was a three percentage point increase in 1980.

catch juveniles more often. Criminology theory suggests that crime rates are influenced by the age structure of potential victims, which may be higher than the offender age structure.

The great majority of studies using regression analysis to estimate the impact of age structure on crime found no significant relationships, but methodological faults may be responsible. Cross section studies are difficult because age structure varies little between jurisdictions, a strong argument against Hirschi and Gottfredson's contention that cross-section research is preferable. Time series studies research suffered principally from lack of adequate sample size and failure to consider the impact of more than one age group.

The poor track record of the forecasts is not strong evidence against the age/crime relationship. Any number of factors not related to age may have overcome the age effect. There is little evidence, however, that the crime age structure has change significantly in recent years.

We explored the age/crime relationship by applying a time series-cross section model, using data for almost all states over the years 1971-88. The analysis includes year effects, which showed that (unidentified) nation-wide factors are very important. We found that age structure does affect all seven types of index crime, although the results for murder, assault, and vehicle theft are only marginally significant. The high impact age groups (those with significant coefficients) are roughly similar to the high arrest groups, but they tend to be

somewhat older and less concentrated in the peak years. The differences are most noticeable for vehicle theft. We interpret these result as supporting the crime-opportunity theory, and any attempts to estimate the impact of age structure must incorporate the impact of victims' age structure. This problem, along with the importance of year effects, lead to the conclusion that it is not useful to estimate the portion of crime trends attributable to age structure and that forecasts based on age structure trends are unlikely to be accurate.

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Table 1

Percent Change in Per Capita Crime Rates

and Percent Population Aged 15 to 24

	Uniform Crime Reports Total Crime Index			National Crime Survey	Percent Population
	Reported Crime		Arrests	Victim-	15 to 24
	Raw	Adjusted	Rates	izations	years old
1972	-5.3	.	-1.7	.	0.6
1973	5.0	.	0.2	.	1.2
1974	17.2	9.8	24.2	6.7	1.2
1975	8.7	4.4	-3.5	1.2	1.0
1976	-0.5	0.1	-4.1	-.8	0.8
1977	-4.3	-0.4	2.2	1.5	0.2
1978	0.8	2.2	0.6	-.8	-0.1
1979	7.9	9.5	0.9	.9	-0.5
1980	8.1	-2.2	-0.1	-3.5	-1.0
1981	-1.2	-0.1	1.3	1.9	-2.0
1982	-4.2	-3.9	7.4	-5.0	-2.5
1983	-6.7	-5.0	-6.7	-7.9	-2.7
1984	-2.8	-2.6	-4.9	-4.8	-2.5
1985	3.7	0.3	2.6	-2.9	-2.3
1986	5.2	1.8	4.3	-3.1	-2.3
1987	1.3	2.7	2.6	.8	-2.9
1988	2.0	.	0.3	2.0	-3.2

Table 2

Percent Annual Change in

Per Capita Reported Crime by Index Types, 1972-1988

	Homicide	Rape	Assault	Robbery	Burglary	Larceny	Vehicle
1972	4.3	9.6	5.5	-3.2	-1.6	-8.2	-7.2
1973	4.2	9.6	6.4	1.4	7.4	4.0	4.1
1974	5.1	7.3	8.5	14.4	18.1	20.8	4.7
1975	-1.8	-1.5	5.2	4.0	6.0	12.5	1.4
1976	-9.2	2.0	0.3	-10.3	-5.9	3.9	-5.2
1977	0.8	10.3	5.4	-4.6	-2.2	-6.8	0.1
1978	1.2	5.3	5.7	2.0	0.6	0.2	1.3
1979	8.6	12.0	8.8	10.8	5.1	8.7	9.4
1980	6.1	6.9	5.4	16.0	12.6	6.9	0.4
1981	-3.5	-1.7	-2.8	3.3	-1.6	-0.5	-4.7
1982	-7.6	-5.6	-0.1	-7.3	-9.6	-1.7	-3.4
1983	-9.0	0.5	-0.5	-6.4	-9.2	-6.5	-4.8
1984	-4.1	5.8	3.9	-4.9	-5.5	-2.7	1.4
1985	0.7	3.2	4.5	1.9	2.0	4.1	5.8
1986	7.4	3.3	14.3	8.1	4.4	3.7	9.9
1987	-3.6	-1.2	1.4	-5.5	-1.1	2.4	4.3
1988	1.2	0.6	5.4	3.7	-1.6	1.7	10.0
1971-88	0.3	88.7	112.4	22.0	15.2	47.4	29.3

Table 3

Percent Annual Change in

Per Capita Reported Crime Types

Adjusted for Underreporting, 1973-1987

	Rape	Assault	Robbery	Burglary	Larceny	Vehicle
1974	1.5	6.1	11.0	16.1	8.4	5.6
1975	-9.4	1.4	4.6	4.3	5.2	-3.8
1976	9.0	-5.2	-10.3	-4.9	2.4	-3.0
1977	-0.5	19.6	-8.4	-3.6	-0.0	1.7
1978	26.1	3.3	12.1	4.2	1.1	4.8
1979	8.2	11.8	0.8	4.0	11.4	6.0
1980	30.1	0.1	13.2	4.5	-4.6	-1.2
1981	-26.8	0.5	5.3	-1.2	0.2	-0.9
1982	-0.4	-9.4	-8.0	-6.3	-2.4	-11.2
1983	12.9	1.5	0.0	-8.1	-5.0	0.6
1984	-11.2	9.9	-8.7	-6.8	-2.0	1.0
1985	-5.3	-4.1	4.4	1.4	0.0	3.1
1986	31.0	13.0	-0.8	-0.8	1.5	6.2
1987	-10.7	0.2	-1.8	-0.7	3.9	3.7

The reported crime figures (see Table 2) are divided by the portion of crimes reported to the police according to victims.

Table 4

Percent Change in Percent of Population in Age Groups

	Age Groups								
	0-4	5-14	15-17	18-24	25-34	35-44	45-54	55-64	65 up
1972	-2.0	-2.5	1.2	0.3	5.3	-1.6	-0.5	0.1	1.0
1973	-2.4	-2.6	0.9	1.3	3.8	-1.1	-0.5	0.2	1.4
1974	-3.1	-2.4	0.5	1.5	3.5	-0.9	-0.9	0.5	1.5
1975	-3.2	-2.2	-0.8	1.9	3.1	-0.9	-1.2	0.7	1.9
1976	-4.1	-2.2	-0.4	1.4	3.1	0.2	-1.5	0.7	1.6
1977	-1.3	-2.9	-1.2	0.9	2.8	1.0	-2.1	0.9	1.6
1978	0.0	-3.2	-1.3	0.4	1.8	2.6	-1.9	0.5	1.5
1979	1.0	-3.4	-2.5	0.4	2.4	1.9	-2.0	0.5	1.4
1980	1.1	-2.8	-3.0	-0.1	2.7	1.6	-1.9	0.4	1.0
1981	1.9	-2.2	-4.7	-0.8	3.0	1.2	-1.7	-0.3	1.0
1982	1.1	-1.6	-5.1	-1.5	0.4	5.2	-1.6	-0.3	1.2
1983	1.0	-1.4	-4.4	-2.0	1.1	3.4	-1.2	-0.4	1.2
1984	0.1	-1.2	-1.8	-2.7	1.1	3.3	-0.7	-0.5	1.1
1985	0.0	-1.0	-0.2	-3.1	1.0	3.0	-0.5	-0.9	1.1
1986	-0.2	-1.2	1.1	-3.6	0.8	3.0	0.0	-1.4	1.2
1987	-0.3	-0.1	-2.2	-3.2	0.3	2.7	1.0	-1.9	1.3
1988	0.0	0.5	-4.6	-2.6	-0.1	1.8	2.8	-1.8	0.8
1971-88	-9.9	-28.0	-25.2	-11.5	42.6	29.7	-13.5	-3.1	24.3

Table 5

Offender Age According to Victims and Arrest Data, 1987

	percent 20 years or less
Robbery	
Victimizations: Perceived age given by victims	
Single offender crimes[a]	27.7
Multiple offender crimes[a]	46.8
Weighted average[b]	36.1
Arrests (123,306 total)	40.3
Rape	
Victimizations: Perceived	
Single offender crimes[a]	21.0
Multiple offender crimes[a]	81.2
Weighted average[b]	25.1
Arrests (31,276 total)	27.7
Assault	
Victimizations: Perceived	
Single offender crimes[a]	30.3
Multiple offender crimes[a]	60.5
Weighted average[b]	36.6
Arrests (973,672 total)	24.9

a = Excludes cases where no age is given. For multiple offender crimes, those by mixed ages divided between the age groups.

b = Based on 567,460 single and 441,780 multiple offender robberies, 131,090 single and 9,810 multiple offender rapes, and 3,476,580 single and 926,660 multiple offender assaults.

Table 6

Summary of Research Regression Results Concerning the Impact of Age Structure on Crime

	Cross Section Studies			Time Series Studies			All Studies		
	Total	Positive		Total	Positive		Total	Positive	
		#	%		#	%		#	%
Total	11	2	18%	2	0	0%	13	2	15%
Violent	3	0	0%	4	2	50%	7	2	29%
Property	6	1	17%	4	3	75%	10	4	40%
Homicide	24	4	17%	17	11	65%	41	15	37%
Rape	9	1	11%	1	0	0%	10	1	10%
Assault	9	3	33%	3	1	33%	12	4	33%
Robbery	13	1	8%	6	2	33%	19	3	16%
Burglary	13	1	8%	5	2	40%	18	3	17%
Larceny	13	1	8%	1	1	100%	14	2	14%
Vehicle	10	1	10%	3	2	67%	13	3	23%
Total	111	15	14%	46	24	52%	157	39	25%

This table summarizes the results of 50 studies listed in Appendix A, plus the results in Land, McCall, and Cohen (1990) and the 14 studies listed there. A positive finding is a significant positive coefficient in at least one analysis.

Table 7

High-Arrest Age Groups, by Crime Index Type, 1970 to 1988

	Peak ages[a]			Peak age arrest rate ratio[b]		
	1970	1980	1988	1970	1980	1988
Homicide	21	19-21	18-19	3.2	3.0	3.7
Rape	18-19	21	18-23	4.3	3.3	2.9
Assault	21-24	19-22	21-23	2.9	2.9	2.7
Robbery	17-19	17-18	18	4.8	5.3	4.5
Burglary	15-16	16-17	16-18	5.6	5.9	5.0
Larceny	15-16	16-17	16-17	4.8	4.5	4.0
Vehicle	16	16	15-16	8.2	7.1	7.3

a = These ages are within 95 percent of the arrest rate (arrests per persons in the age group) for the peak age; some intervening ages are below the 95 percent level.

b = The arrest rate for the peak age divided by the total arrest rate for the crime category.

Table 8

Age Groups with High Arrest Rates

	Arrest Rates Above Average			Arrest Rates Twice Average			Arrest Rates Four times average		
	1970	1980	1988	1970	1980	1988	1970	1980	1988
Homicide	15-46	16-42	15-39	17-33	17-29	17-27	----	----	----
Rape	14-36	14-39	14-39	15-29	16-28	15-29	18-20	----	----
Assault	14-45	14-42	14-40	16-31	16-28	16-29	----	----	----
Robbery	13-31	13-31	13-34	14-26	14-25	14-28	16-21	16-19	17-18
Burglary	12-28	12-28	12-32	12-22	13-22	13-24	14-18	14-18	15-18
Larceny	11-28	11-30	11-35	12-21	13-21	13-22	14-17	15-17	----
Vehicle	13-26	13-24	13-30	14-21	14-22	13-23	14-18	14-18	14-18

Dashes indicate that no age group had arrest rates four times average. The data are from Federal Bureau of Investigation 1988 and unpublished statistics supplied by the Bureau. The sources give arrest rates for individual ages for 15 to 24 only. Otherwise arrest rates are grouped for 12 and under, 13-14, 25-29, and every five years thereafter. Arrest rates for ages within these age groups were estimated by assuming a straight line trend within each group and assuming that all the under 12 arrests are in the 10-12 age category.

Table 9

Crime Rates and Age Group Sizes, 1971-1988,

Time Series-Cross Section Regression

With First Differences of Logs

Independent Variables	Dependent Variables							
	Total	Homicide	Rape	Assault	Robbery	Burglary	Larceny	Vehicle
5 to 14 years	.74*** (3.59)	-.12 (.17)	.41 (.93)	.61 (1.34)	.24 (.48)	.38 (1.37)	.93*** (4.02)	.70* (1.67)
15 to 17 years	.39** (3.14)	.14 (.34)	.10 (.38)	-.08 (.31)	1.01*** (3.33)	.79*** (4.72)	.30* (2.15)	.17 (.70)
18 to 24 years	.37* (2.01)	-.72 (1.15)	1.47*** (3.71)	.80* (1.97)	.59 (1.30)	-.21 (.87)	.61** (2.98)	.65* (1.77)
25 to 34 years	.49* (2.19)	1.31* (1.68)	1.79*** (3.68)	.94* (1.89)	1.74** (3.11)	.51* (1.68)	.32 (1.28)	.86* (1.89)
35 to 44 years	-.18 (.77)	.66 (.82)	1.42** (2.88)	.54 (1.06)	.43 (.76)	-.11 (.35)	-.09 (.31)	-1.28** (2.75)
45 to 54 years	.37 (1.51)	.31 (.36)	.26 (.49)	-.24 (.45)	.47 (.78)	.05 (.17)	.46* (1.66)	.93* (1.90)
55 to 64 years	-.17 (.93)	.52 (.82)	.59 (1.50)	1.26** (3.12)	.39 (.87)	-.39 (1.60)	-.12 (.60)	-.16 (.43)
Error Correction	-.24 (10.67)	-.71 (20.93)	-.35 (13.31)	-.25 (10.66)	-.29 (11.90)	-.22 (9.81)	-.24 (11.25)	-.15 (7.42)

Table 9 (cont.)

	Total	Homicide	Rape	Assault	Robbery	Burglary	Larceny	Vehicle
Year dummy coefficients (intercept for 1972)								
1972	-.05	-.02	.02#	.01	-.07	-.03	-.07	-.10
1973	.11#	.02#	.03#	.02#	.06	.10#	.12	.12
1974	.21#	.06#	-.02	.03#	.19#	.20#	.26#	.14
1975	.15#	-.01	-.07	.03#	.08	.09#	.21#	.08
1976	.06	-.13	-.08	-.05	-.12	-.03	.13#	.03
1977	.03	-.01	.02#	.00	.02	.02	.03	.14
1978	.09	-.01	-.03	.01	.08	.05#	.11	.19#
1979	.17#	.04#	.05#	.05#	.16#	.10#	.20#	.24#
1980	.16#	.03#	.00	.00	.18#	.17#	.18#	.13
1981	.07	-.05	-.07	-.06	.10#	.04#	.11	.06
1982	.05	-.11	-.11	-.04	.04	-.03	.10	.14
1983	.01	-.11	-.03	-.05	.00	-.04	.04	.10
1984	.05	-.09	.03#	.04#	.02	-.03	.07	.18#
1985	.11#	.00#	.01#	.05#	.09#	.04	.13#	.23#
1986	.11#	.03#	.01#	.11#	.13#	.04	.13#	.24#
1987	.09	-.04	.00	.01	.04	.03	.12	.18#
1988	.08	.00#	.02#	.07#	.14#	.02	.09	.19#
F, yr dum	88.75	5.80	9.42	7.05	26.34	59.28	93.93	18.96
D.V. mean	.019	-.003	.039	.039	.015	.009	.024	.012
Adj. R^2	.71	.41	.33	.24	.45	.66	.71	.36
D-W	1.67	2.12	2.11	1.77	1.85	1.68	1.72	1.60

Each regression includes all states, except Illinois (and South Dakota for Murder) for 1971-88. There are 808 degrees of freedom, with 791 for the murder regression. * = age variables significant at the .10 level; ** = significant at the .01 level; *** significant at the .001 level. # = year dummy coefficients that are above the median.

Table 10

Comparison of High Impact and High Arrest Age Groups

	Age Groups				
	5-14	15-17	18-24	25-34	35-44
Homicide					
High Impact				X	
Arrest rate above avg.		15+	all	all	to 42
" " twice avg.		17	all	to 29	
Rape					
High Impact			XXX	XXX	XX
Arrest rate above avg.	14	all	all	all	to 39
" " twice avg.		15+	all	to 29	
Assault					
High Impact			X	X	
Arrest rate above avg.	14	all	all	all	to 42
" " twice avg.		16+	all	to 29	
Robbery					
High Impact		XXX		XX	
Arrest rate above avg.	13+	all	all	to 31	
" " twice avg.	14	all	all	26	
" " 4 times avg.		16+	to 19		
Burglary					
High Impact		XXX		X	
Arrest rate above avg.	12+	all	all	to 28	
" " twice avg.	13+	all	to 22		
" " 4 times avg.	14	all	18		
Larceny					
High Impact	XXX	X	XX		
Arrest rate above avg.	11+	all	all	to 30	
" " twice avg.	13+	all	to 21		
" " 4 times avg.		all			
Vehicle theft					
High Impact	X		X	X	
Arrest rate above avg.	13+	all	all	to 26	
" " twice avg.	14	all	to 22		
" " 4 times avg.	14	all	18		

The high impact age groups are from the regression in Table 9. X = significant to the .10 level, XX = significant to the .01 level, and XXX = significant to the .001 level. The high arrest groups calculated by taking the median upper limits and median lower limits for 1970, 1980, and 1988 (Table 8).

Table 11

Crime Rate Growth and Impact of Age and Year Effects

	1971-1988			1978-1988		
	Percent change in state crime[a]	Estimated impact of age structure[b]	Estimated impact of year effects[c]	Percent change in state crime[a]	Estimate impact of age structure[b]	Estimate impact of year effects[c]
Murder	-9%	59%	-40%	-11%	14%	-30%
Rape	100%	108%	-22%	32%	44%	-9%
Assault	92%	27%	23%	32%	-11%	18%
Robbery	27%	53%	114%	10%	-1%	90%
Burglary	19%	2%	74%	-8%	-13%	34%
Larceny	47%	-47%	196%	13%	-32%	117%
Vehicle	15%	-40%	229%	12%	-55%	169%

a = The percent change in the average state crime per capita.

b = The sum of the products of each significant age group coefficient (Table 9) and the 1971-88 or 1978-88 percent change in the average percent of persons in that group.

c = The sum of the year effects (Table 9) times 100.

Appendix A

Regression Studies of the Impact of Age Structure on Crime

Part A. Cross Section Studies

	Age Group[a]	Crime Type[b]	Result[c]	Units and Years
Brier & Fienberg (1980)	18-20	Total	++	states 1970
Byrne (1986)	18-25	Robbery	---	910 cities
		Burglary	-	1975
		Larceny	-	
		Auto	--	
Cohen & Land (1984)	15-24	Rape	ns	26 cities
		Robbery	+++	1970
		Assault	+++	
		Burglary	+++	
		Larceny	+	
		Auto	+++	
DeFronzo (1983)	15-24	Rape	+	39 SMSAs
		Assault	+	1970
		Robbery	-	
		Burglary	-	
		Larceny	-	
		Auto	-	
Ehrlich (1973)	males 14-24	Homicide	+?	states 1960
		Rape	+?	
		Assault	+?	
		Robbery	ns	
		Burglary	ns	
		Larceny	ns	
		Auto	ns	
Ehrlich (1977)	15-24	Homicide	--	30-35 states 1940, 1950
Frost (1976)	18-20	Total	+	states 1970
Fujii & Mak (1979)	15-24	Homicide	-	25 districts
		Rape	+	in Oahu,
		Assault	-	Hawaii
		Robbery	-	1975
		Burglary	---	
		Larceny	-	
		Auto	+	

		Burglary	-	
		Larceny	+	
		Auto	+	
Furlong & Mehay (1981)	males 15-24	Total	--	38 police districts, Montreal 1973
		Property	--	
		Robbery	--	
		Burglary	--	
		Larceny	--	
Greenberg & Kessler (1982)	0-17	Tot, Hom	ns	98 cities 1970
		Rape, Ass		
		Rob, Bur		
		Lar, Auto		
Greenberg et al. (1983)	15-30	Violent	+	252 suburbs 1960&70
		Property	+	
Hoch (1974)	0-20	Homicide	--	36 SMSAs 1960, 1970
		Rape	ns	
		Assault	ns	
		Robbery	--	
		Burglary	+	
		Larceny	ns	
		Auto	--	
Howsen & Jerrell (1987)	15-24	Robbery	-	120 Kentucky counties 1980
		Burglary	---	
		Larceny	---	
Huff & Stahura (1980)	15-30	Violent	+?	252 suburbs 1971
		Property	+?	
Joubert et al. (1981)	15-25	Total	+?	states 1970
		Violent	-	
		Property	+?	
McPeters & Stronge (1974)	15-24	Total	+	43 cities 1970
Mikesell & Pirog-Good (1990)	5-14	Property	---	states 1970-84?

1955-71

Appendix A (cont.)

a - The percent of population in the age group. When more than one age group is given, they are entered in separate regressions except Pogue (1975).

b - The crimes are reported crime, except in Wolpin (1978, 1980) and Zedlewski (1983).

c - The results are:

- ns not significant, direction not given.
- m mixed - the direction varies with different analyses.
- + positive, not significant to .05 level (when t-ratios are given the significance level is taken to be 1.965).
- +? positive, but the report does not indicate whether it is significant to the .05 level (in almost all instances, it is doubtful that they are significant).
- ++ in studies with multiple analyses, one or more is significant (excludes analyses presented only as preliminary, incomplete analyses).
- +++ significant to .05 level (in all or over three-fourths of the analyses).
- -, --, and --- are the negative versions of +, ++, and +++.

d - The trend controls are:

- ctr - adds a counter (1,2, etc.) or total population.
- dif - uses first differenced variables.
- gra - uses a Granger test.

e - The time series analyses use year data unless noted otherwise.