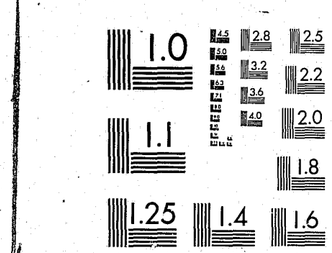

National Institute of Justice
United States Department of Justice
Washington, D.C. 20531

CRIME AND ARREST RATE PROJECTIONS FOR THE STATE AND THE NATION: 1976-1980

FRED ANDERSON

COMMONWEALTH OF VIRGINIA
DIVISION OF JUSTICE AND CRIME PREVENTION
STATISTICAL ANALYSIS CENTER

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Purpose

The purpose of this paper is to encourage the exploration of methods of forecasting for use in criminal justice planning, and to present a method and the results of forecasting arrests for index crimes* by violent and property groupings. Specifically, in presenting the results of this work we will point out shortcomings in traditional straight line trend or linear regression techniques which rely too heavily upon mathematical formulae and too little upon inate characteristics of the subject population.

Introduction

During the 1960's and early 1970's, Virginia and the nation experienced a virtual explosion in crime. The index crime rate in 1975 was 2.8 times the rate in 1960 and there were more than 3.3 times as many reported offenses. Figure 1 (p. 2) illustrates the growth of crime in the U. S. and Virginia as measured by index offense rates. Congress, in passing the Omnibus Crime Control and Safe Streets Act of 1968, addressed the problem through emphasis placed on planning in criminal justice systems at the state and local levels.

Requisite to any planning activity is a forecast of future requirements. The mandate from Congress, with its emphasis on planning, underscored the need for improvement in criminal justice forecasting. This emphasis is manifested in the annual guidelines for the preparation of State Comprehensive Plans which contain increasingly more extensive requirements for forecasts and projections.

*Index crimes as defined by the F.B.I. and Virginia State Police include the offenses of Murder and Non-negligent Manslaughter, Forcible Rape, Robbery, and Aggravated Assault under the category of Violent Crimes and Burglary, Larceny-Theft and Auto-Theft under the category of Property Crimes.

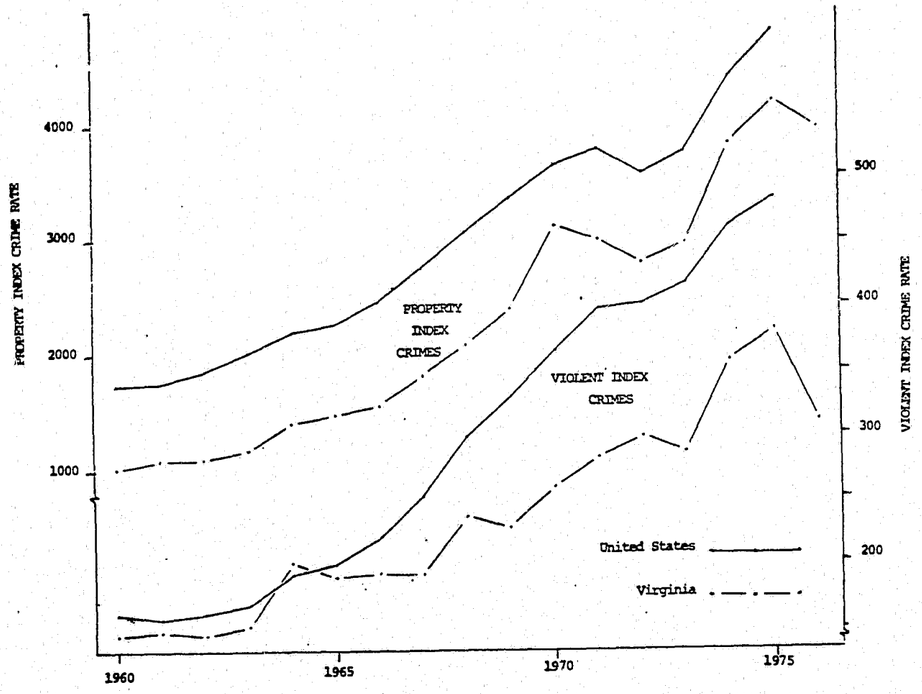


FIGURE 1 INDEX CRIME RATES FOR THE UNITED STATES AND VIRGINIA 1960-1975

There is a danger that such extensive guidelines will become an end in themselves, and to some extent they have, concealing the real use of forecasting, goal setting and resource allocating in the flurry of activity necessary to meet deadlines. Be that as it may, those of us responsible for anticipating the future, as all are who have any involvement in planning, have an obligation to seek and utilize all available information relevant to the processes being projected. There may be insufficient time to pursue all avenues in the search for "the best projection", but our time would be better spent in establishing an acceptable basis for future public expenditures than in debilitating our energies in reactive analyses of events we failed to anticipate.

In attempts to foster the development of forecasting for use in criminal justice system planning, attention has been focused on measures of crime, especially the FBI's Uniform Crime Reports and, in particular, reported index offenes. It is only proper that index crime and rates receive this attention because they are the best indicators we have; thus, justifying their use in estimating the pervasiveness of crime in years to come.

But establishing a valid use for forecasts does not address the question of exactly how one goes about obtaining them. When this question arises, the normal response is to look to the field of statistics for a projection technique, usually regression analysis. Most people realize that regression projections are based upon the continuation of trends currently operative. So long as in-depth knowledge of the processes being projected supports that assumption, the regression technique cannot be faulted. There is a danger, however, in applying the technique to a set of data with insufficient knowledge of the underlying processes to be able to judge whether these assumptions are valid.

Population Characteristics

In the case of crime, we are dealing with two factors: first, the rate at which crimes are committed, usually expressed as crimes, offenses, or arrests per 100,000 people and second, the total number of people for which this rate is descriptive. For example, a certain city may have a population of 500,000 (5 x 100,000) and crime rate of 1000 (offenses per 100,000 people). The total number of crimes committed is the product of these two factors or 5000 crimes.

If the population increases by 100,000, the number of crimes would increase to 6000 (1000 crimes per 100k people times 6 100K people). But, if during the same period unemployment and inflation hit that city hard, resulting in an increase of 400 in the rate per 100,000 people at which crimes were committed, then instead of 6000 crimes the city would have had to deal with 8400 crimes (1400 x 6). Thus, from looking only at totals we are unable to determine whether an increase in crime is due to a rising population or whether the increase was caused by a greater propensity of the population to commit crimes.

So what of the increasures in crime rates reported during the 1960's and early 1970's? In a previous paper (Anderson, 1976) we examined arrests as reported for the nation in 1970 and 1975 during which time the arrest rate per 100,000 people rose from 4334 to 4469 or 3.1% and total arrests rose by 8.4% (p. 7). Rather than examine a single arrest rate for the entire population we calculated rates for individual age groups as determined by 5 year increments. The paper asked the question, ". . . what would happen if the arrest rate within each age group remained constant during the period 1970 to 1975".

By appying these 1970 rates to 1975 populations, we found that total arrests projected in this manner differed from the actual number by only one-tenth of one percent. This means that although rates did change for

individual age groups (some increased and some decreased) the fact remains that the actual number of arrests in 1975 could have been predicted quite accurately five years earlier.

But more importantly, this work demonstrated, first, the importance and dramatic effect that shifts in the distribution by age can have upon total population parameters (such as rates) and second, these parameters can be highly misleading if taken at face value without a thorough understanding of the underlying demographic forces. It is worth while repeating once more the nature of the population age distribution phenomena behind what we term the post war baby boom; particularly as it affects the ages having the highest crime rates (13 to 29 years of age).

Post War Baby Boom

Immediately after World War II the number of children born in the United States began a series of large annual increases which continued until 1958. During the post war years the annual number of births grew from 2.8 million in 1954 to 4.3 million in 1958 and remained at that level until 1962 when the birth rate began declining (Figure 2, p.7). It is interesting to note that the number of births began to rise again in 1967-70 as children of the baby boom, themselves, began reaching child bearing age. This secondary effect was reversed through increased availability of birth control measures as the effects of over population (especially in ages 15 - 29) and inflation began to moderate the inclination to have children. The decreasing birth rate is shown more clearly in Figure 3 (p. 7) which graphs the number of births per 1000 females of child bearing age (15 - 44 yrs.). Note that the decline in birth rate (1961-1973) is even more extreme than the increase (1945-1957).

This period of increasing and then decreasing birth rates produced an inordinately high concentration of people who are now age 14 through 30. In 1960, persons aged 15 to 29 made up 19.7% of the U.S. population (Figure 4, p. 8). In 1970 that proportion had grown to 24.5% and by 1980 it will peak at 27.4% and then begin declining. Virgini's population has experienced a similar transformation. Ages fifteen to twenty-nine comprised 21.7% and 26.0% of the total state population in the years 1960 and 1970, and in 1980 will make up 28.4% of the total (Figure 5, p. 8). Virginia's population characteristics appear to lag behind those of the nations by about five years, probably due to the heavy migration of young adults into the state which tends to delay the effects of the declining birth rate.

Working in concert with the growth of the young adult population has been the well documented propensity of these ages to commit crimes. In

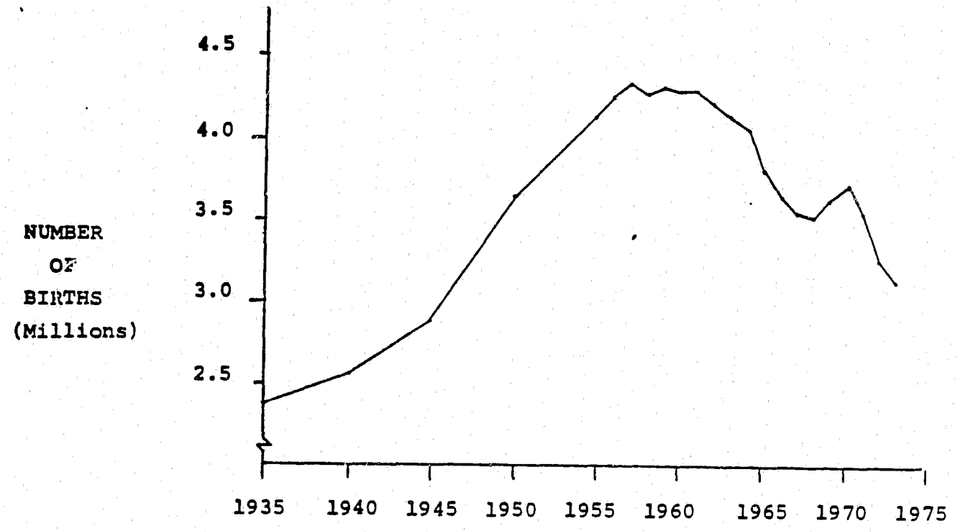


FIGURE 2 NUMBER OF BIRTHS IN THE UNITED STATES 1935 - 1975

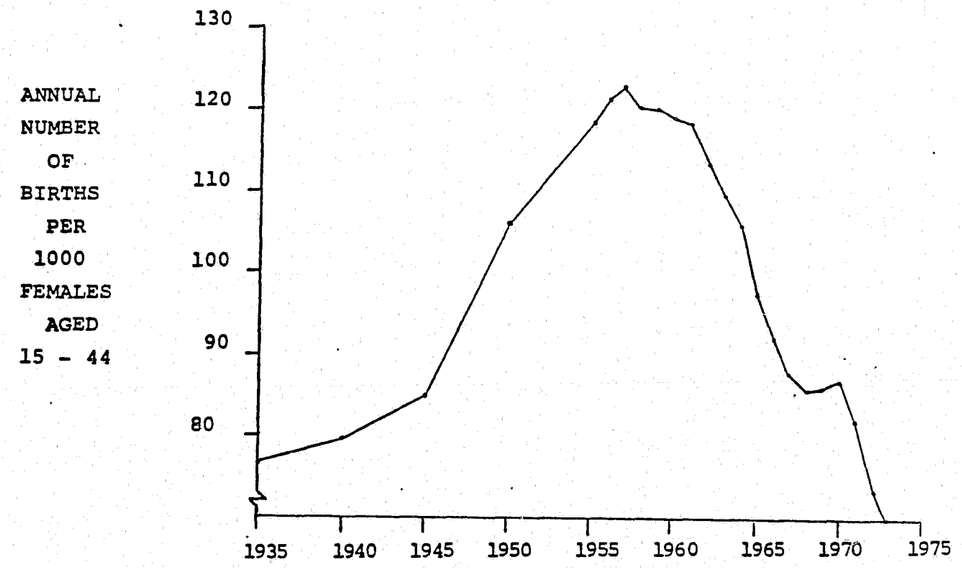


FIGURE 3 ANNUAL BIRTH RATE IN THE UNITED STATES 1935 - 1975

FIGURE 4 U.S. POPULATION OF CRIME PRONE AGES AS A PERCENT OF TOTAL POPULATION

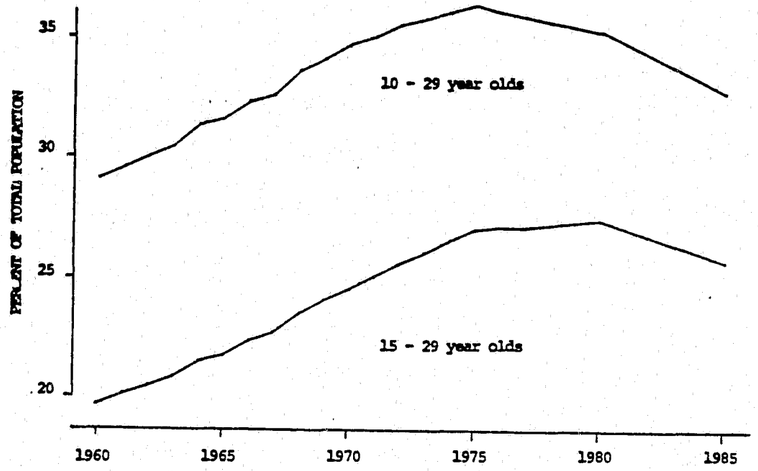
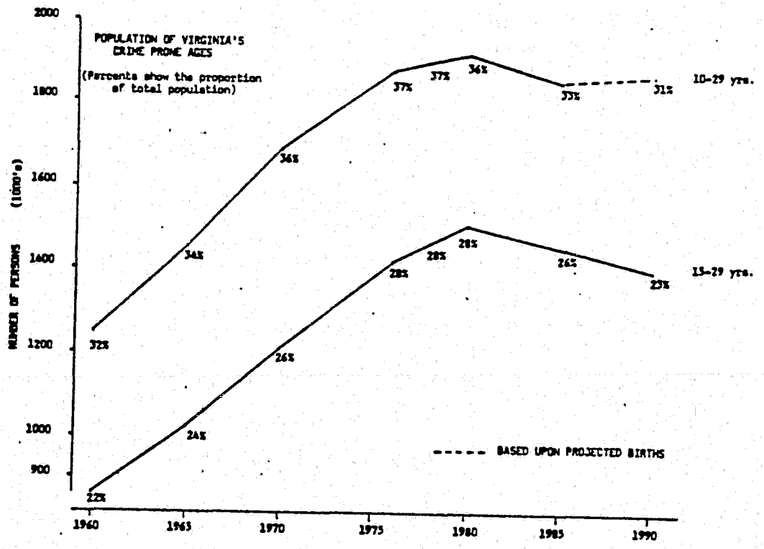


FIGURE 5



1975, in Virginia people of 10 to 29 years of age constituted 65% of all arrests for violent index offenses and 82% of all arrests for property index offenses. Because of the significantly higher arrest rates, we have termed 13 to 29 as the crime prone ages. Index arrests per 100,000 people aged 10 to 29, in 1975, were 3.2 times as high as all other ages for violent index offenses and 7.4 times as high for property offenses.

The rise in crime since 1960 corresponds precisely with the rise in numbers of the crime prone ages. For the sixteen years of data including 1960 through 1975, the population of the group aged 15 to 29 correlates highly with both the U.C.R. Index Rate (.985) and with our calculated arrest rates (.975). We examined correlations between the index crime rate for this period and the population of various age groupings, finding that the 15 to 29 year range produced the highest correlation.

Recognition of the vast differential in crime rates that exist between various age groups, in itself, points out the importance of age distribution in any analysis and projection of crime. Further, the fact that population projections by age can be produced quite accurately for the next 13 years covering those ages with the highest arrest rates (13 to 29 years), represents a sound basis upon which to build crime forecasts.

Method

The first problem we encounted in attempting to examine arrest rates in Virginia was the lack of data. Arrests by age are available only since 1975 when the State adopted a mandatory U.C.R. reporting program.

To overcome this, we made the assumption that trends in arrest rates for Virginia would parallel those for the United States. Actually, crime rates for the U.S. and Virginia as measured by the U.C.R. Crime Index show similar trends (Figure 1, p. 2). Correlations between the U.S. and Virginia indexes are quite high, .992 for property crimes and .971 for violent crimes for the years 1960 through 1975. In addition, the U.C.R. index of reported offenses for the U.S. correlates highly (.988) with U.C.R. arrest rates for index offenses during the same period. For these reasons, we feel fairly confident in assuming that trends in Virginia arrest rates have been similar to those experienced nationally.

The next step was the somewhat tedious task of calculating arrest rates for the two index crime categories, for each of the age groups, and for each year from 1964 through 1975. We chose 1964 as the first year simply because previous issues of Crime in the United States did not report a subtotal for Part I arrests (Index Offenses plus Manslaughter by Negligence). It was important to begin in the early 60's in order to include the baby boom effects.

In defining age groups, we chose the most detailed groupings for which data was easily obtained; generally, five year groupings were used with the following exceptions. First, ages 45 and above were grouped in ten year increments to correspond to available U.S. population reports. Second, for the age of 10 there is an inconsistency in the data available for the study. While arrests are reported for ages 0 through 10, national population statistics are readily available only in age groupings of 5 years.

This means that population figures are used for ages 0 through 9 and 10 through 14, while arrest figures reflect ages 0 through 10 and 11 through 14.

Because the number of persons 10 and under who are arrested is relatively small compared to the number aged 11 through 14, (8% for violent crimes and 13% for property), we assumed that this inconsistency would produce no significant inaccuracy. Even if all persons arrested in the 10 and under group were 10 year olds, the arrest rates for ages 10 - 14 would be increased by a maximun of 13% for property crimes. Thus, actual total arrests and arrest rates for 10 to 14 year olds are somewhat higher than those reported here; likewise, the true figures for ages 10 and under will be slightly lower than those calculated.

In order to estimate total index arrests in the nation, we adjusted the figures obtained from the U.C.R. according to the proportion of the total population represented by reporting agencies. By inflating U.C.R. arrest figures in this manner, the assumption is made that agencies not reporting make arrests at the same frequency as those who do file uniform crime reports. This assumption is probably not accurate because agencies who do not report, in all likelihood, include predominantly small low crime jurisdictions. This condition is indicated by steady declines since 1966 in the average population represented per reporting agency, (C, in Figure 8, P. 14) as more jurisdictions join the U.C.R. program. Due to this assumption, total arrests will tend to be high, as will arrest rates which were calculated by dividing the population of the appropriate age group, expressed in 100,000's, into the estimated number of arrests. The source of population figures for the United States was the U.S. Bureau of the Census publication, Statistical Abstract of the United States: 1973, (Table 3, 6-7). Values were obtained for years not reported by interpolating between age cohorts to get fifth year estimates and

interpolating between age groups to obtain all others.

In order to project arrest rates for each age group and crime category an analysis of the historical rates were necessary. Arrest rates for age groups with the highest incidence of crime are shown in Figures 6 and 7, (p. 13) for the years 1964 to 1975. These graphs reveal generally consistent trends over all age groups and years.

The year 1974, distinguished by disproportionately large rate increases, draws our attention due to its proximity to our projection period. The impact of the 1974 phenomena affected the crime prone ages (10-29) to a greater degree than other age groups and the property crime category more than violent crime. Arrest rates for 15-19 year olds increased by 28% for property, 22% for violent offenses. This same phenomena is also revealed by reported offenses for property and violent crimes (Figure 1, p. 2) for both Virginia and the nation which also reveal significant increases in 1974.

The fact that something unusual happened in 1974, not isolated to crime prone ages or property crimes but affecting them to a greater degree, does not in itself justify the exclusion of those data points from our trend analysis. However, a brief examination of the number of agencies and population represented by published U.C.R. statistics suggests that arrests reported in 1974 were subject to significant departures from the criteria of previous years.

The number of index arrests reported per agency (B. in Figure 8, p. 14) jumped by 22% and then fell by 15% the next year, 1975, the most dramatic changes during the entire sixteen years since 1960. During recent years more states have been adopting a mandatory U.C.R. reporting program; the number grew from 13 in 1971 to 36 in 1975. Generally this is reflected by the continuing decrease in average population per agency (C. in Figure 8 p. 14) as more and more smaller agencies began participating. The general

FIGURE 6

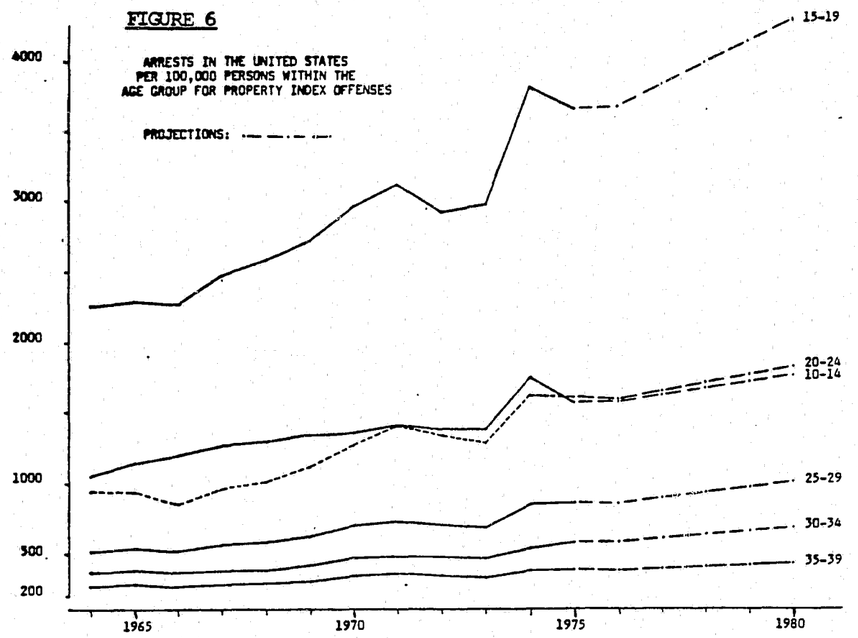
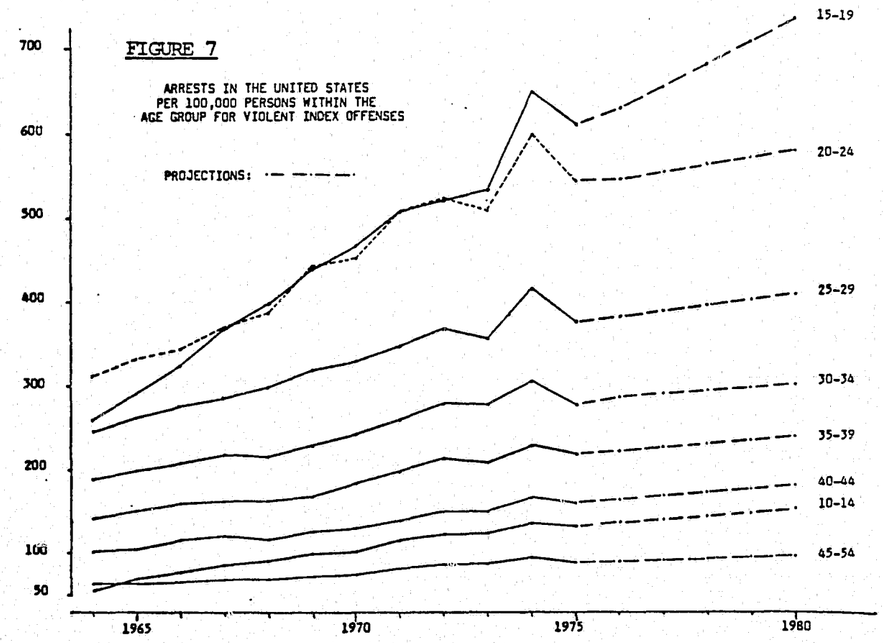


FIGURE 7



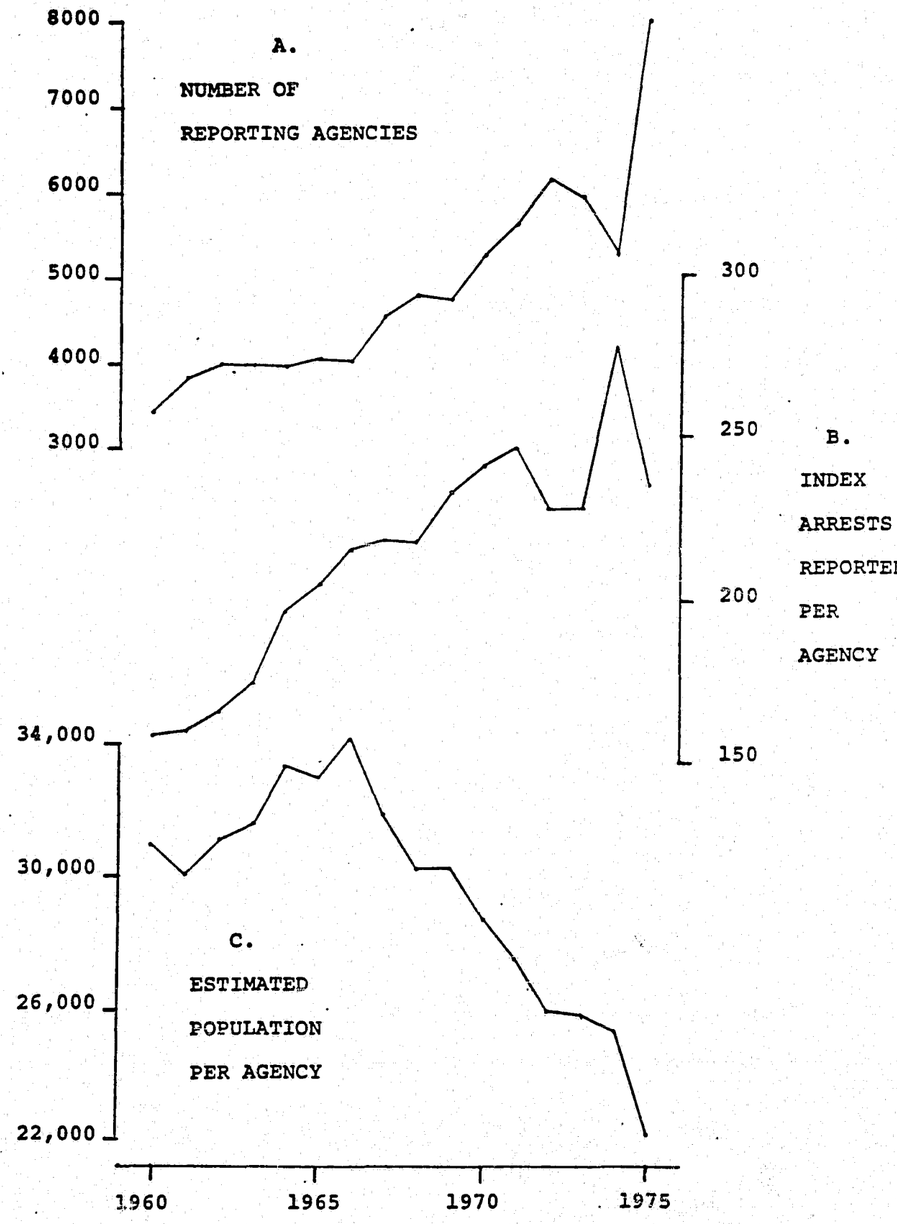


FIGURE 8 PROFILE OF LAW ENFORCEMENT AGENCIES REPRESENTED BY PUBLISHED U.C.R. ARREST STATISTICS

upward trend of graph A, in Figure 8 (p. 14) illustrates an increasing number of participating agencies with the exception of 1973 and 1974 when, contrary to all efforts to expand the U.C.R. program, there was a two year decline in the number of agencies for whom arrests were reported in the U.C.R. manual. For these reasons, we chose to exclude U.C.R. data for 1974 arrests.

Our choice of years defining the current trend period was guided by several factors. First, from the earlier discussion of population and the movement of the boom babies into and through the crime prone ages, any trend which may be driven by population size will be changing as the numbers of people aged 13 to 29 reaches its peak and begins to decline (Figures 4 and 5, p. 8). Second, preliminary U.C.R. press releases for 1976 in the nation, while too incomplete to be used for data, demonstrate that both index offenses and arrest show significant decreases over 1975. For Virginia, corresponding decreases are shown in Figure 1, page 2. Therefore, we felt we had to choose a trend period more consistent with these 1976 decreases. Third, a visual inspection of all arrest rate graphs (Figures 6 and 7, p. 13), especially the rates for the age group 15 to 19 and 20 to 24, supports the assumption of a new trend commencing in 1971. For these reasons, the years 1971, 72, 73, and 75 were chosen as representative of trends currently operative.

Using the straight line regression technique with data for these years, we projected arrest rates through 1980 for each age group and each arrest category. These projections are shown by dotted lines in Figures 6 and 7.

At this point, we digress slightly from the development of Virginia arrest projections to mention that we also projected U.S. arrests by multiplying the rates obtained as above by the appropriate population projections and totaling these by crime category and year. These projections for the U.S. are presented along with those developed for Virginia later in this paper.

Our next step in developing Virginia arrest projections was to use the slope of the regression lines calculated for the U.S. to establish linear projections for the State.

Consider the general form of an equation for a straight line:

$$Y = a + bx$$

the parameters a and b are obtained from the regression procedure. By dividing the equation by the base year arrest rate (Y' = the arrest rate in 1976) we can develop the proportionate increase in Y (arrest rate) per unit increase in X (year) as follows:

$$\frac{Y}{Y'} = \frac{a + bx}{Y'} = \frac{a}{Y'} + \frac{bx}{Y'}$$

Thus, b/Y' is the slope we used for Virginia projections. Being a proportionate change, we converted to an actual slope by merely multiplying by the base year arrest rate for Virginia:

$$b(Va.) = \frac{b \cdot Y'(Va.)}{Y'(U.S.)}$$

The intercept is then easily determined by solving the equation of a line for "a" and using the 1976 Virginia data points:

$$a(Va.) = Y'(Va.) - b(Va.) \cdot X'(Va.)$$

The resulting set of equations were used to project Virginia arrest rates by age groups and crime category for the years 1971 through 1980. These projections are graphed in Figures 9 and 10 (p. 17) for the age groups having the highest rates. We then multiplied the projected rates by the appropriate population projections to obtain forecasts of the number of index offense arrests.

Overall arrest rates for the State and nation (mentioned earlier) were calculated by summing arrests by crime category and year and then dividing by the total population. These forecasts are represented in Figure 11 (p. 18).

Arrests for ages 10 through 29 are pictured in Figur 12 (p. 18) for

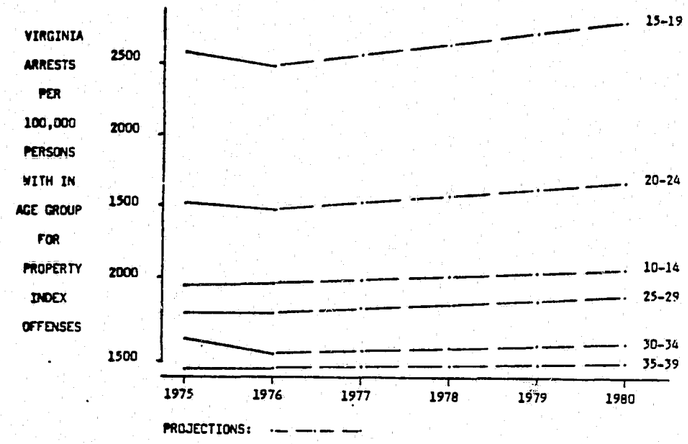


FIGURE 9 VIRGINIA PROPERTY INDEX OFFENSE ARREST RATES

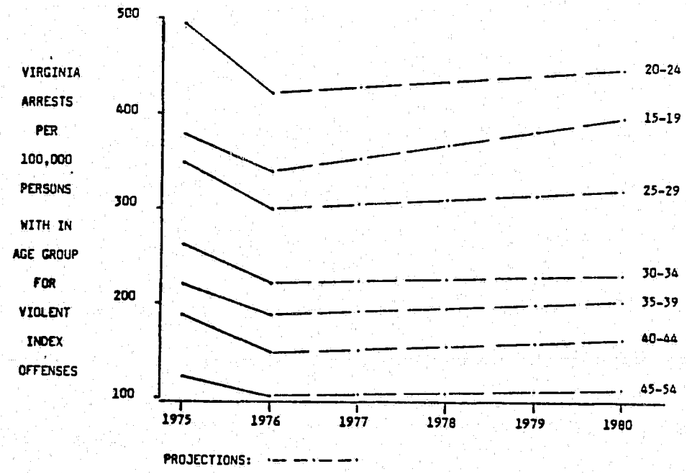


FIGURE 10 VIRGINIA VIOLENT INDEX OFFENSE ARREST RATES

FIGURE 11

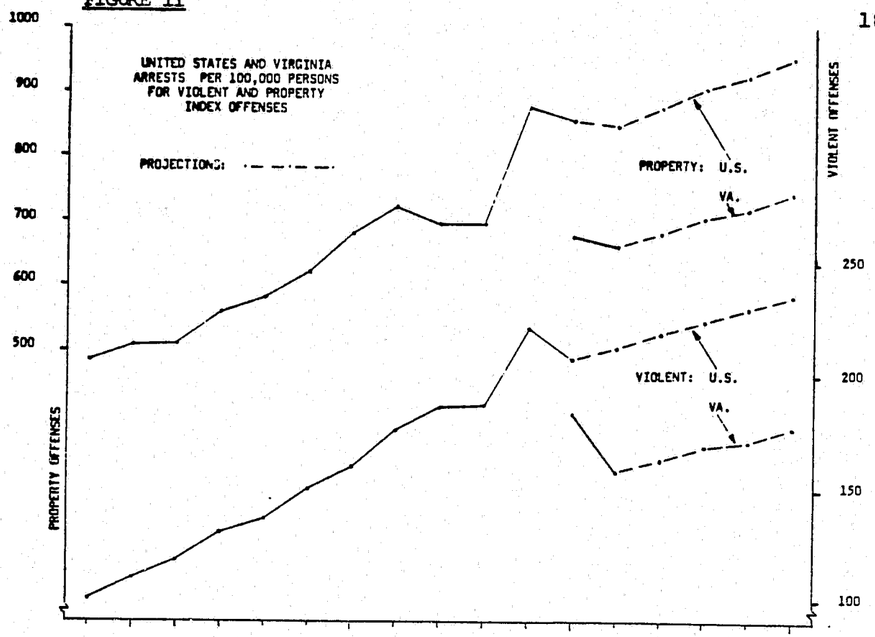
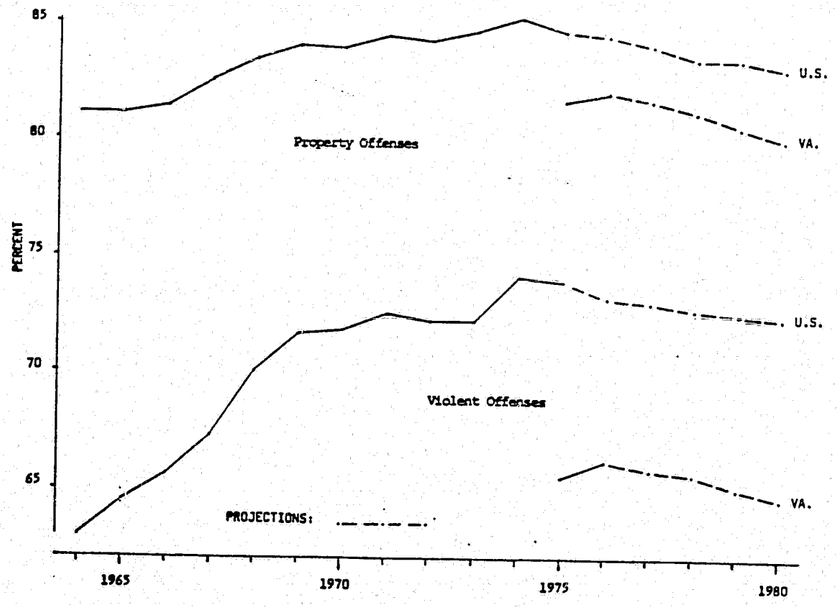


FIGURE 12 ARRESTS OF 10-29 YEAR OLDS AS A PERCENT OF TOTAL INDEX OFFENSE ARRESTS



both the State and nation, as a percent of all index arrests.

Crime Index Projections

The high correlation (.988) between index crime arrests and reported offenses indicates a strong linear relationship between the two (Figure 1, p. 2). Determination of the parameters of this relationship via linear regression analysis enabled us to forecast national offense rates using our arrest rate projections. Similarly, because of the high correlations between state and national crime indexes, we feel a forecast of Virginia property and violent crime rates using this linear relationship is valid. Graphs of these projections are shown in Figures 13 and 14 (p. 20).

Beyond 1980

Demographic characteristics of both state and national populations with respect to age, enable us to predict with a high degree of accuracy barring unanticipated extreme shifts in migration patterns, the size of the crime prone population for at least the next 15 years. Until that time, populations of these age groups will consist of children who are already born. Accuracy of projections past that time depend primarily upon our ability to forecast birth rates during the next 15 years. Present fertility rates are at an all time low (1.8 children per woman in 1975) but experts generally agree that at some point in the future the current downward trend will reverse and rates will rise and eventually stabilize at the replacement level of 2.1 children per woman. But these considerations will not have a direct effect upon crime until after 1990.

Between 1980 and 1990 the number of people aged 15 to 24 will decrease by 16.3%. Thus the number of arrests will also decline unless rates for this group increase by at least 19.5%. This is not large compared to increases of 80% or more experienced from 1965 to 1975; however, rising

FIGURE 13

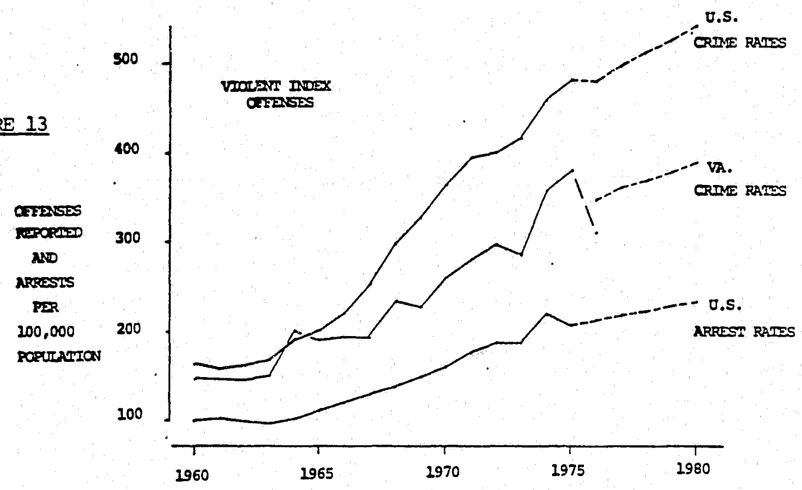
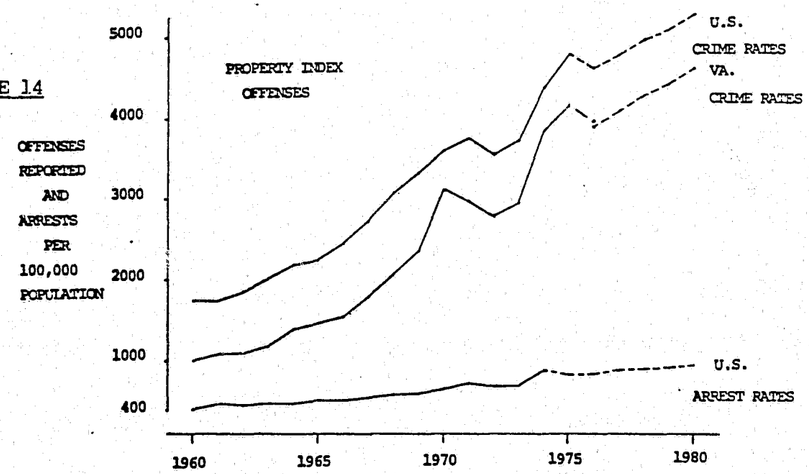


FIGURE 14



arrest rates during this period were accompanied by large increases in young adult populations (52% for ages 25-29), dramatic social and political change (Vietnam dissent, sexual revolution, political assasinations, corruptions in high government offices, and human rights movements including women and racial minorities) and economic crisis (inflation, recession, unemployment, and the implications of limited resources such as energy, wheat, sugar, etc.). Of these conditions indicating a high degree of social instability, most can be related to the population explosion of the crime prone ages, at least indirectly, by the knowledge that in failing to anticipate the impact of such large increases in the number of young adults we were incapable of adequately meeting the social, economic, political, material and esthetic needs of this group.

At some point during the past two years, the number of 18 year olds reached its peak, This means that for at least the next 18 years, we will see steady national declines in the young adult population. Individual localities may prove to be exceptions due to inordinately high migration rates.

In summary, with the passage of the baby boom peak by 1980, the size of the crime prone age group will be decreasing during the next decade. These decreases will cause a corresponding decrease in crime unless rates increase enough to compensate for decreased populations. There are several conditions which indicate at least a leveling off of rates and probably a general decline. First, is the fact that crime rates are correlated in longitudinal studies over a period of years with unemployment (Brenner, 1976). Unemployment, to no small degree, has been influenced by the sheer numbers of baby boom populations entering the job market; many studies have established that the highest unemployment in the county has been experienced in young urban males. In the future, with smaller numbers entering the job market, this situation must improve in order to avoid major

economic collapse. Second, as the boom children age the percent of total population which are young will decrease. This shift away from the youth oriented society of the 60's and 70's will introduce the greater social and economic stability that goes with age. Third, there is an upper limit to crime rates that cannot be exceeded without destroying society. We have already approached this limit in the areas of drugs and draft evasion. In both cases society has incorporated changes in its very structure in order that it avoid disintegration.

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