Improving Crime Data

Analysis of St. Louis Rape, Motor Vehicle Theft, Aggravated Assault, and Homicide Rates, 1995-2003

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Go to Press Release & Special Reports

Go to ICD Project

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Like most U.S. cities, St. Louis has experienced a substantial drop in serious crimes since the early 1990s. However, not all crimes have decreased. Motor vehicle thefts have risen sharply in recent years, and rapes have dropped. These changes may be a function of changes in crime coding or classification procedures. In this report, we track the trends between 1995 and 2003 in four crime types: rape, motor vehicle theft, aggravated assault, and homicide. For three of the crime categories (rape, motor vehicle theft, and homicide) we then compare the number of recorded offenses for 2003 with estimates derived from a statistical model applied to data from the 95 U.S. cities with more than 175,000 residents. Our results indicate that St. Louis has a much smaller number of police-recorded rapes and a much larger number of motor vehicle thefts than would be expected for a city of its size and population characteristics. The number of homicides, by contrast, is somewhat lower than we would expect for a city of the size and characteristics of St. Louis, possibly due to recent law enforcement interventions to reduce violent crime.

Trends Since 1995

Figures 1-4 display the average trends in the four crime types for the 95 cities (minus St. Louis) and the St. Louis trends since 1995. (The data are from the FBI's Uniform Crime Reports.) Figure 1 presents the rape trends since 1995. St. Louis had a higher than average rate of rape in 1995. By 1997, the St. Louis rate had fallen below the average for the 95 cities. Although most cities have experienced a decline in police-recorded rapes since 1995, the drop in St. Louis has been much greater than elsewhere. Between 1995 and 2003, rape rates in St. Louis fell by 68%, compared with an average decrease of 25% for the 95 largest cities. By 2003 St. Louis ranked 86th among the 95 cities in rapes per 100,000 residents. In 1995 St. Louis ranked 3rd.

As shown in Figure 2, the auto theft rate for the 95 cities declined by about 25% between 1995 and 2003. During the 1990s St. Louis had auto theft rates roughly double those of other large cities. That ratio was reasonably stable until 2000, when the St. Louis auto theft rate began a precipitous rise. By 2003 the St. Louis rate was almost 80% higher than in 1999. In 1995 St. Louis had the 6th highest auto theft rate among the 95 cities; in 2003 St. Louis ranked 1st, outpacing second-ranked Detroit's auto theft rate by nearly 30%.

Aggravated assault trends for St. Louis and other large cities are displayed in Figure 3. The average aggravated assault rate for the 95 cities fell from 744 per 100,000 population in 1995 to 494 per 100,000 in 2003, about a 34% drop. The St. Louis aggravated assault rate declined by 38% over the same period. Throughout the period, St. Louis averaged well over twice the aggravated assault rate of other large cities.

Homicide trends between 1995 and 2003 are shown in Figure 4. St. Louis homicide rates fell by 60% over the period, from roughly 55 to 22 homicides per 100,000. The average homicide rate for the 95 cities declined by a more modest rate of 28%. In St. Louis and the other large cities, the homicide drop began to flatten out by the late 1990s. The St. Louis homicide rate actually increased from 1998 to 2001. It then began to fall again through 2003. The timing of this second "countercyclical" homicide drop coincides with the introduction of law enforcement interventions to reduce firearm violence in St. Louis, under the Strategic Approaches to Community Safety Initiative (SACSI) and Project Safe Neighborhoods (PSN).

Comparing St. Louis to Other Cities

Table 1 displays the number of rapes, motor vehicle thefts, aggravated assaults, and homicides recorded in St. Louis and three cities comparable to St. Louis in size and other population characteristics: Cincinnati, Kansas City, and Atlanta.

Table 1. Crime Counts in Cincinnati, Kansas City, Atlanta, and St. Louis, 2003

	Cincinnati	*Kansas City*	*Atlanta*	*St. Louis*
Rapes	307	308	281	81
Motor Vehicle Thefts	3449	5600	7235	11966
Aggravated Assaults	1081	3871	4360	3874
Homicides	71	82	149	74

The number of rapes recorded in St. Louis is well under half the number recorded in the three comparison cities in 2003. The number of recorded auto thefts in St. Louis is markedly higher than in the comparison cities. The number of aggravated assaults and homicides recorded in St. Louis, by contrast with rape and vehicle theft, does not differ greatly from the respective numbers in the comparison cities. The aggravated assault count in St. Louis is nearly identical to that in Kansas City and somewhat smaller than in Atlanta. Cincinnati has less than one-third the number of aggravated assaults as Kansas City, Atlanta, and St. Louis. St. Louis, Cincinnati, and Kansas City record similar numbers of homicides; Atlanta had roughly twice as many as the other cities in 2003.

Expected Number of Crimes in St. Louis

We estimated the "expected" number of rapes, motor vehicles thefts, and homicides in St. Louis from statistical models that reliably predict differences across the 95 cities in these crime types. The "expected" number of crimes is the number St. Louis would have assuming it had the mean values on the covariates in the model. The estimates are only as good as the fit of the model to the data. Assaults differ substantially over time and across cities in the way they are classified by the police. Due to the resulting measurement error, we could not create a model with an acceptable level of fit to the aggravated assault data and have not produced expected aggravated assault counts for St. Louis.

Rape. The expected number of St. Louis rapes in 2003 was estimated from an equation that models rape as a linear function of six variables that reliably predict differences across cities in rape rates: the female labor force participation rate, the divorce rate, percent of families with children headed by a female, population density, population size, and percent of the population between the ages of 15 and 24.. The equation is given below:

$$RAPE = a + b_1(FLAB) + b_2(DIV) + b_3(FFAM) + b_4(POPDEN) + b_5(POPSIZE) + b_6(AGE15\text{-}24), \text{ where} \quad \text{Eq. (1)}$$

RAPE = Rapes per 100,000 population (natural log);
FLAB = Percent of females 16 and over in civilian labor force;
DIV = Percent of persons 15 and over divorced;
FFAM = Percent of families with children under 18 headed by a female;
POPDEN = Persons per square mile (natural log);
POPSIZE = Population size (natural log); and
AGE15-24 = Percent of the population between 15 and 24.

Equation (1) was fit to data for the 95 US cities with 2000 populations greater than 175,000. The rape data are from the FBI's *Uniform Crime Reports*, and the data for the covariates are from the 2000 US Census. To produce reliable parameter estimates and avoid overfitting, the average 2000-2002 rape rates for the 95 cities were first regressed on the covariates using ordinary least squares. The 2003 rape rates were then regressed on the fitted values from this equation. The predicted 2003 St. Louis rape rate per 100,000 was obtained and converted to a count. We achieved reasonably good model fit; over half of the variance in rape rates across the 95 cities is explained by the model. The prediction equation is given below:

$$RAPE_{00\text{-}02} = -.271 + .020(FLAB) + .096(DIV) + .041(FFAM) - .130(POPDEN) + .139(POPSIZE) + .034(AGE15\text{-}24). \quad \text{Eq. (2)}$$

$R^2 = .545 \quad F = 17.545 \quad p < .001$

Regressing the 2003 rape rates for the 95 cities on the fitted values from Eq. (2) yields an expected St. Louis rape rate of 59 per 100,000. Converting the rate to a count produces

an expected rape count of 201, or 120 more than the 81 rapes recorded by the police in 2003.

Motor Vehicle Theft. The number of auto thefts in St. Louis is much higher than would be expected based on characteristics generally related to auto theft in large US cities. We estimated the number of auto thefts in St. Louis in 2003 as a linear function of five variables that reliably predict auto theft rates across cities: the male unemployment rate, percentage of the population black, percentage of the population living in the same residence 5 or more years, population density, and the divorce rate. The equation is given below:

$$VTHEFT = a + b_1(UNEMP) + b_2(PCTBLK) + b_3(SAMRES) + b_4(POPDEN) + b_5(DIV), \text{ where} \qquad \text{Eq. (3)}$$

VTHEFT = Motor vehicle thefts per 100,000 population (natural log);
UNEMP = Male unemployment rate;
PCTBLK = Percentage of the population black;
SAMRES = Percentage of population living in same residence 5 or more years;
POPDEN = Population density (natural log); and
DIV = Divorce rate

As before, the equation was fit to the 2000-2002 UCR and 2000 census data for the 95 largest US cities. The 2003 motor vehicle theft rates were then regressed on the fitted values from this equation. The predicted 2003 auto theft rate per 100,000 for St. Louis was obtained and then converted to a count. The prediction equation is given below:

$$VTHEFT_{00\text{-}02} = 3.330 + .0814(UNEMP) + .0077(PCTBLK) - .0305(SAMRES) + .304(POPDENS) + .131(DIV) \qquad \text{Eq. (4)}$$

$R^2 = .545$, $F = 21.308$ ($p < .001$)

The statistical model provides reasonably good fit to the data, explaining over half of the variance in motor vehicle theft rates across the 95 cities. The model yields an expected auto-theft rate in St. Louis of 1,726 thefts per 100,000 population in 2003. The expected rate corresponds to 5,873 auto theft offenses, or about one-half of the 11,966 auto thefts recorded by the St. Louis police that year.

Homicide. We estimated the expected number of homicides in St. Louis from an equation consisting of four variables that reliably predict homicide rates across large US cities: an index of economic and social disadvantage, a measure of residential segregation by race, the percentage of the population living at the same residence 5 or more years, and the firearm suicide rate. The disadvantage index combines five highly intercorrelated variables: the poverty rate, male unemployment rate, % black, % female-headed families with children under 18, and median family income. The equation is given below:

$$HOMICIDE = a + b_1(DISADVAN) + b_2(SEG) + b_3(SAMRES) + b_4(GUNSUIC), \quad \text{Eq. (5)}$$

where

HOMICIDE = Homicides per 100,000 population (natural log);
DISADVAN = Factor score for social and economic disadvantage index consisting of poverty rate, male unemployment rate, % black, % female-headed families with children under 18, and median family income;
SEG = Index of dissimilarity of black and white residential patterns;
SAMRES = Percentage of population living at same residence 5 or more years; and
GUNSUIC = Firearm suicides per 100,000 population

We fit Eq. (5) to 2000-2002 UCR homicide data and 2000 census data for the 95 largest cities and achieved very good fit: The equation explains over two-thirds of the variance in homicide rates. The estimation results are given below:

$$HOMICIDE_{00\text{-}02} = 1.925 + .541(DISADVAN) + .018(SEG) - .022(SAMRES) + .065(GUNSUIC) \quad \text{Eq. (6)}$$

$$R^2 = .780 \quad F = 79.755 \; p < .001$$

Regressing the 2003 homicide rates for the 95 cities on the fitted values from Eq. (6) yields an expected 2003 St. Louis homicide rate of 29.01 homicides per 100,000 population and an expected count of 99 homicides. The expected count is somewhat higher than the 74 homicides recorded by the police in 2003.

Conclusion

Our analysis of St. Louis rape, motor vehicle theft, aggravated assault, and homicide levels and trends produces mixed results. For two of the crime types, homicide and aggravated assaults, we find that St. Louis does not diverge markedly from expected patterns, although the results for aggravated assault must be viewed with caution given the variability across cities and over time in assault classification procedures. For rape and motor vehicle theft, on the other hand, St. Louis differs from other large cities in both the time trends for these offenses and their expected levels in 2003. The frequency of recorded rapes in St. Louis is much lower in recent years than expected based on rape rates elsewhere, controlling for several factors that predict rape rates in US cities. The pattern is the opposite for vehicle theft: St. Louis records substantially more vehicles thefts than expected.

The results for rape and motor vehicle theft raise the possibility that St. Louis differs from other cities in the rate at which these offenses are reported to the police or in the way they are classified by the police. It is also possible that St. Louis has experienced a sharp decline in rapes over the past few years and a large increase in vehicle thefts. The limits of the statistical models must be kept in mind when interpreting these results. Although the models explain over half the variance across the 95 largest cities in rape and vehicle theft rates, much of the variance in these crime types remains unexplained.

Further insight into the divergence of St. Louis from the experience in other cities can be gained from a detailed examination of classification and coding procedures applied to rape and motor vehicle theft.

Figure 1. Rape Trends, 1995-2003: St. Louis and Cities Over 175,000 Population (N=95)

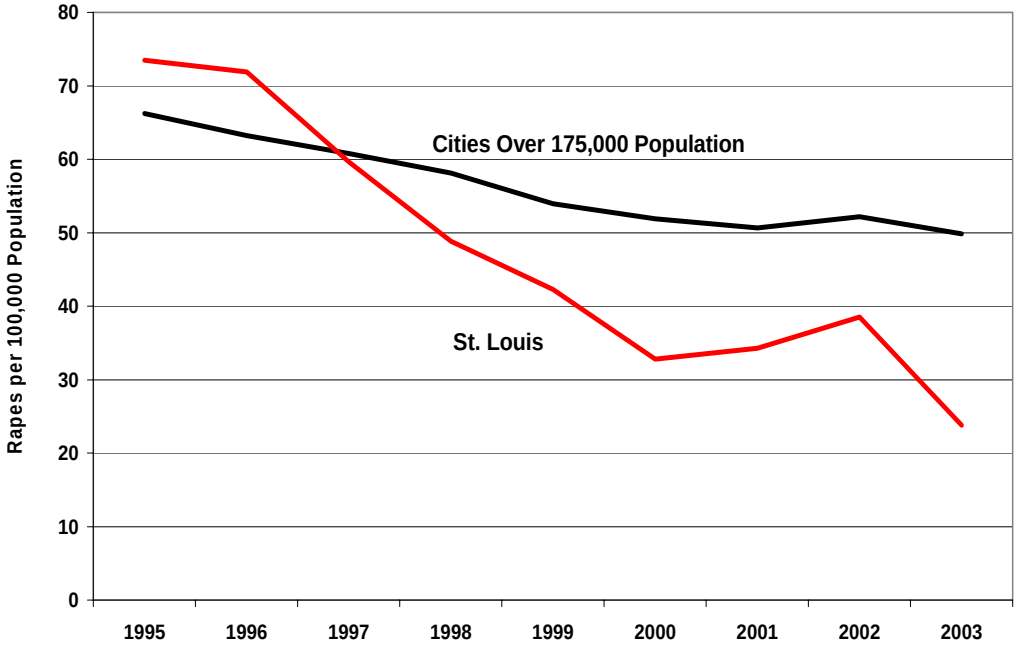

Figure 2. Motor Vehicle Theft Trends, 1995 - 2003: St. Louis and Cities over 175,000 (N = 95)

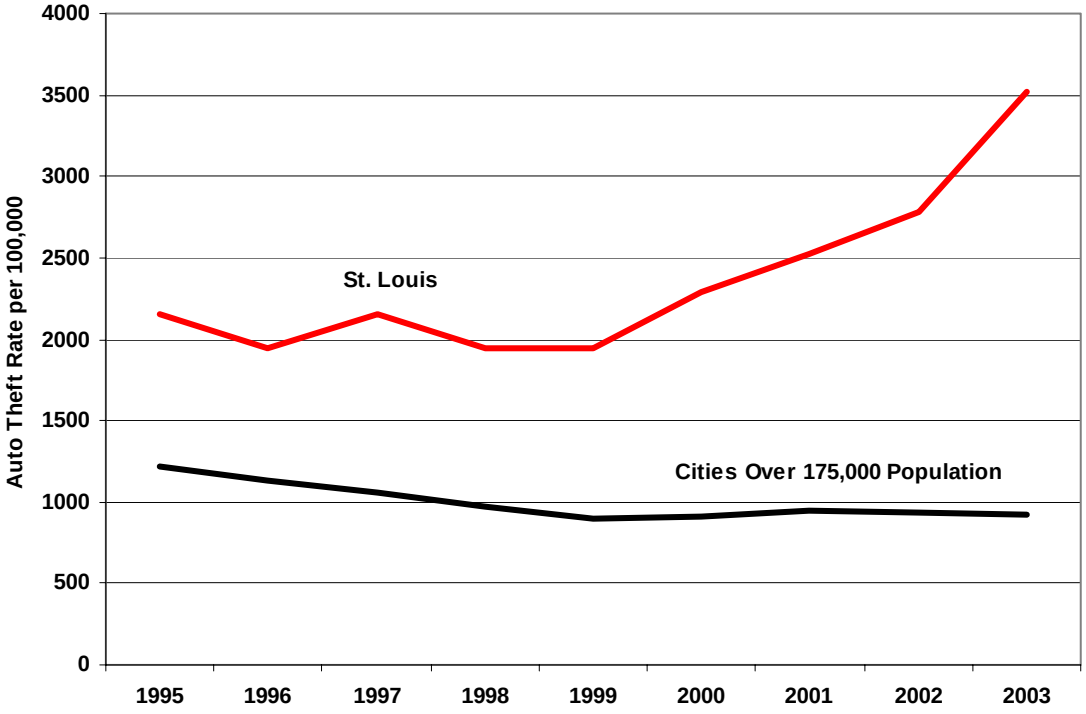

Figure 3. Aggravated Assaut Trends, 1995 - 2003: St. Louis and Cities Over 175,000 Population (N = 95)

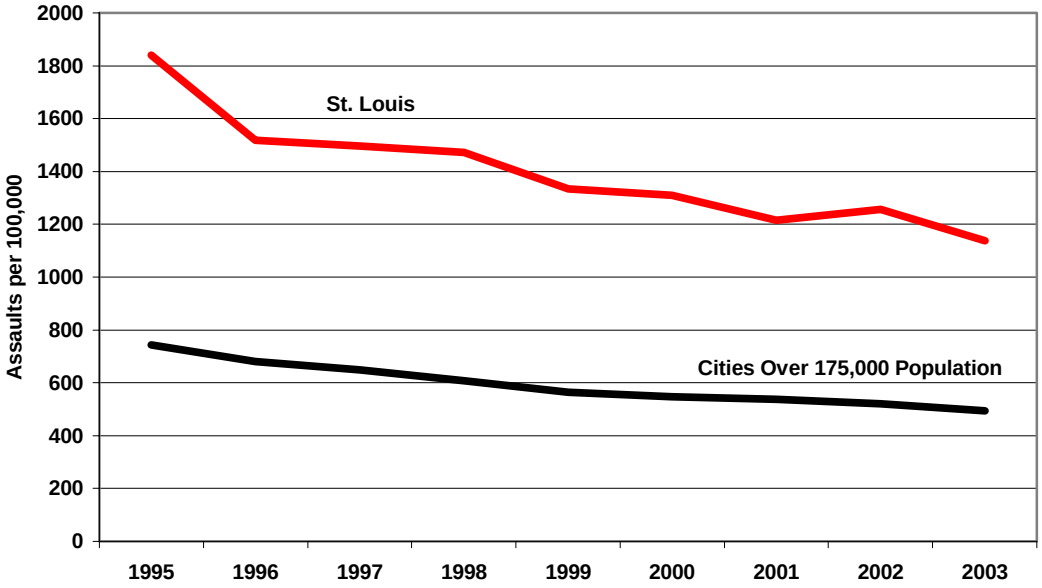

Figure 4. Homicide Trends, 1995 - 2003: St. Louis and Cities Over 175,000 Population (N = 95)