The Future of Crime in New York City and the Impact of Reducing the Prison Population on Crime Rates

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Summary

New York City's rates of violent and property crime for the past sixty years have shared the nationwide trends: a fairly steady increase beginning in the mid-1960s, peaks in the mid-80s and early 90s, and then a sustained decline or flat trajectory for the past three decades.

Those charged with crafting criminal justice policy would benefit from reliable forecasts of near-term crime trends. Employing a very small number of predictive variables, we created statistical models, one for violent crime and one for property crime, whose estimated yearly changes in New York's crime rates from the early 1960s through 2021 corresponded very closely to the actual ones. We then used these models to forecast annual changes in crime rates though 2026. The projections for violent crime are small increases in 2022 and 2023 followed by declines through 2026. The property-crime projections are slight increases through 2026.

We also used the violent crime model to project crime rates under a hypothetical 25% reduction in New York State's imprisonment rate over a five-year period beginning in 2021. The resulting projections are very slight yearly increases in violent crime, ranging from no increase to an increase of just over 1%. We thus conclude that under a substantial augmentation of the state's two-decade decarceration trend, New York City would experience scarcely any reduction in security in exchange for the economic and social benefits of reducing reliance on imprisonment for crime control.

Introduction

Major changes in America's crime rates have occurred since the 1960s. After several decades of relative stability, a significant, unanticipated uptick in crime began in the mid-1960s, reaching historic peaks in the early 1980s and then again in the early 1990s. Between 1960 and 1991, crime rates more than tripled. Just as unexpectedly, crime then started what became a long and steady decline, eventually returning to mid-1960s levels. Crime trends in New York City have followed these national trends.

This historical volatility means policymakers are uncertain whether crime rates will continue their current long-term decline, stabilize, or begin once again to increase. The ability to forecast near-term changes would be immensely useful to those responsible for choosing among crime policy options. While a reasonable body of research has identified factors associated with past crime rates (e.g., Rosenfeld 2011; Rosenfeld and Levin 2016), little attention has been paid to projecting future crime rates.

With funding from The Harry Frank Guggenheim Foundation (HFG), we developed a model for predicting crime rates based on factors that were associated with the rapid increase and subsequent decline in US crime rates from 1960 to 2021, with forecasts to 2026.[1] While a national-level overview is useful, it is simply the weighted average of the conditions that influence crime rates and the decisions reflected in crime-control policies in smaller jurisdictions, which may vary widely. State and local studies are needed to analyze the conditions and policies that affect local crime trends.

The current study examines the effects of a small set of factors on violent crime and property crime rates in New York City.[2] We found that a statistical model based on past values of the city crime rate and state imprisonment rate, plus a measure of the cost of living (inflation divided by median household income) explained past variation in crime rates with minimal error. Different models were not needed to explain the year-to-year variation in violent and property crime: the results are robust not only within crime types, but also between them.

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1 James Austin and Richard Rosenfeld, 2023. *Forecasting US Crime Rates and the Impact of Reductions in Imprisonment: 1960–2025*. New York, NY: The Harry Frank Guggenheim Foundation.
2 The violent crime rate is the sum of the homicide, aggravated assault, rape, and robbery rates. The property rate is the sum of the burglary, larceny, and motor vehicle theft rates.

We then used the model to forecast New York City crime rates through 2026. We also conducted a hypothetical policy experiment to estimate the impact on the forecasted crime rates of a sizable reduction in the New York State prison population. We found negligible effects of decreasing the incarceration rate on New York City crime rates.

Modeling Crime Rates

A statistical model that would guide policymaking must meet two requirements: (1) it must include factors that not only explain the outcome but also are modifiable by policy, and (2) it must be accurate. Our forecasting model of New York City crime rates stands up well against both of these criteria. It incorporates policy variables with robust effects on violent and property crime rates, and it produces estimates that are generally very close to the observed values of the crime rates.

With just sixty annual observations, the effects of a large number of variables cannot be reliably estimated in a forecasting model. With a longer time series, we could have included in our model several additional variables known to affect crime trends. These include the age composition of the population, lagged and contemporaneous birth rates, numerous economic indicators, such as poverty and economic growth rates, and several criminal justice indicators. We experimented with a large number of models containing a varying mix of demographic, socioeconomic, and criminal justice variables before settling on a model that contains only the past year's imprisonment rate and the current year's inflation rate, adjusted by median household income. Prior research has shown that each of these variables is associated with changes in crime rates over time, and the logic for including them in our model is fairly straightforward. Increases in the imprisonment rate are expected to reduce crime on the assumption that punishment incapacitates offenders and deters criminal behavior. The magnitude of the effect of imprisonment on crime varies widely across studies, however, and some studies indicate that it weakens at high levels of imprisonment (National Research Council 2014).

Prior research indicates that inflation has strong and consistent effects on crime committed for monetary gain: as retail prices increase, so does the demand for cheaper stolen goods (Rosenfeld and Levin 2016). Inflation is also expected to contribute to both violent and property crime by reducing confidence in government and other institutions (LaFree 1999). Crime rates, especially the property rate, should vary with purchasing power, which is the rationale for adjusting the inflation rate by median income (inflation/median household income). The imprisonment rate and income-adjusted inflation rate are incorporated in the multivariate forecasting models described below.

The Near Future of Crime in New York City

Forecasting the future of crime is always risky because such predictions are based on crime-related factors whose future values are unknown. Projecting changes in crime rates, even in the near term, is especially difficult in the current period. Since 2020, the social response to the COVID-19 pandemic and the widespread unrest surrounding violent police actions have influenced crime rates in ways that were difficult to foresee (Rosenfeld, Boxerman, and Lopez 2023). If the study of crime trends is to have policy relevance, however, it will come mainly from forecasting. Policymakers have an interest in past crime rates mainly insofar as they portend future rates. The planning horizon for criminal justice policy rarely extends beyond a few years, and forecasting models should be calibrated accordingly.

Forecasting models will always contain error. They may be *inaccurate* (the crime rate falls outside the forecast range) or *imprecise* (the crime rate is within the forecast range, but the range is so broad it has little practical utility). Useful and reliable forecasting always involves a tradeoff between accuracy and precision.

Finally, crime forecasting is the most exacting way to test hypotheses about changes in crime rates. To avoid overfitting the data used to develop it, an empirical model should always be evaluated with "out-of-sample" observations. The typical way of testing a statistical model of the change over time in crime rates is to determine how it fits the data used to generate the model—in other words, data on *past* crime rates. This is a necessary but not sufficient method of theory testing. An adequate test will assess how well the model predicts values that were not used in its construction. This test does not require waiting until the future arrives; it simply requires reserving some data from the sample used to generate the model and measuring how well it predicts these out-of-sample observations. We perform such a validation exercise in our forecasts of New York City's violent and property crime rates through 2026.

Forecasting Method

We derive our forecasts of New York City crime rates from sample data spanning the period 1960 to 2011. Two out-of-sample forecast periods are examined. The first is the period between 2012 and 2021. This ten-year out-of-sample period, for which the violent and property crime rates are known, is used to validate the forecasts derived from a model based on the 1960–2011 data. We chose a ten-year validation period to minimize "continuity bias" in our forecasts (i.e., the disproportionate influence of very recent values of the crime rates). The violent and property crime rates for 2022 to 2026 are then forecasted. Although the start of this period precedes the time of publication, the crime rates for these years are not yet known. The forecasting exercise is summarized in the text, and technical details can be found in the Appendix.

A first step in forecasting the values of a time series is to evaluate the series for "stationarity." A stationary series is one in which the mean and variance of the series are constant or nearly so over time. Forecasts of a stationary time series are more reliable than those of a nonstationary series. Statistical tests confirmed that the violent and property crime rates in the 1960–2011 estimation period are nonstationary.

A common approach to transforming a nonstationary time series to a stationary series is to first-difference the series. First-differencing transforms a series measured in levels (in this case, crime rates) to one in which each data point is the difference between the variable's current and previous level (i.e., $Y_t - Y_{t-1}$). Second- and higher-order-differencing can be applied if first-differencing does not produce stationarity. First-differencing was sufficient to produce stationarity in the violent and property crime series (see Appendix).

Autoregressive integrated moving average (ARIMA) models were used to forecast the first-differenced violent and property crime rates. ARIMA models are commonly used in forecasting because they offer a thorough assessment of the data-generating process in a time series. A parsimonious multivariate ARIMA model was created that contains the two variables with the most robust effects on crime rates in the Rosenfeld and Levin (2016) study: the inflation rate (adjusted by median household income) and the imprisonment rate.[3] The imprisonment rate is lagged one

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[3] The inflation data are from the Bureau of Labor Statistics (https://www.bls.gov), and the imprisonment data are from the Bureau of Justice Statistics (https://bjs.ojp.gov). The inflation rates for 2023–2026 and the income and imprisonment rates for 2022-2026 were unknown at the time of this writing. The 2023–2026 inflation rates were assumed to be equal to national inflation forecasts from the Congressional Budget Office (https://www.cbo.gov/data/budget-economic-data#4). The forecasted 2022–2026 income and imprisonment values are based on the average yearly rate of change in these measures between 2017 and 2021 (2.7% and -5.4%, respectively). For example, the median household income forecast for 2022 is assumed to be 2.7% greater than median household income in 2021, the forecast for 2023 is 2.7% greater than the 2022 forecast, and so on.

year behind the crime rate. Lagging the imprisonment rate helps to mitigate but does not fully eliminate the estimation error associated with the "endogeneity" of imprisonment (the fact that the imprisonment rate is, in part, a function of the crime rate, so that this year's imprisonment rate may be partially caused by this year's crime rate). Lagging the imprisonment rate removes some of this reverse causality.

The forecast models were fit to the first-differenced violent and property crime rates between 1960 and 2011. The years 2012 to 2021 were "held back" from the models so they could be used to validate the forecasts from the 1960–2011 baseline period. The closer the forecasted crime rates are to the observed rates during the validation period, the greater our confidence in the forecasts for 2022 to 2026, when the crime rates are unknown. The forecast results are presented in Figures 1 and 2.

FIGURE 1. OBSERVED AND FORECASTED YEAR-OVER-YEAR CHANGE IN NEW YORK CITY VIOLENT CRIME RATE, 1961-2026
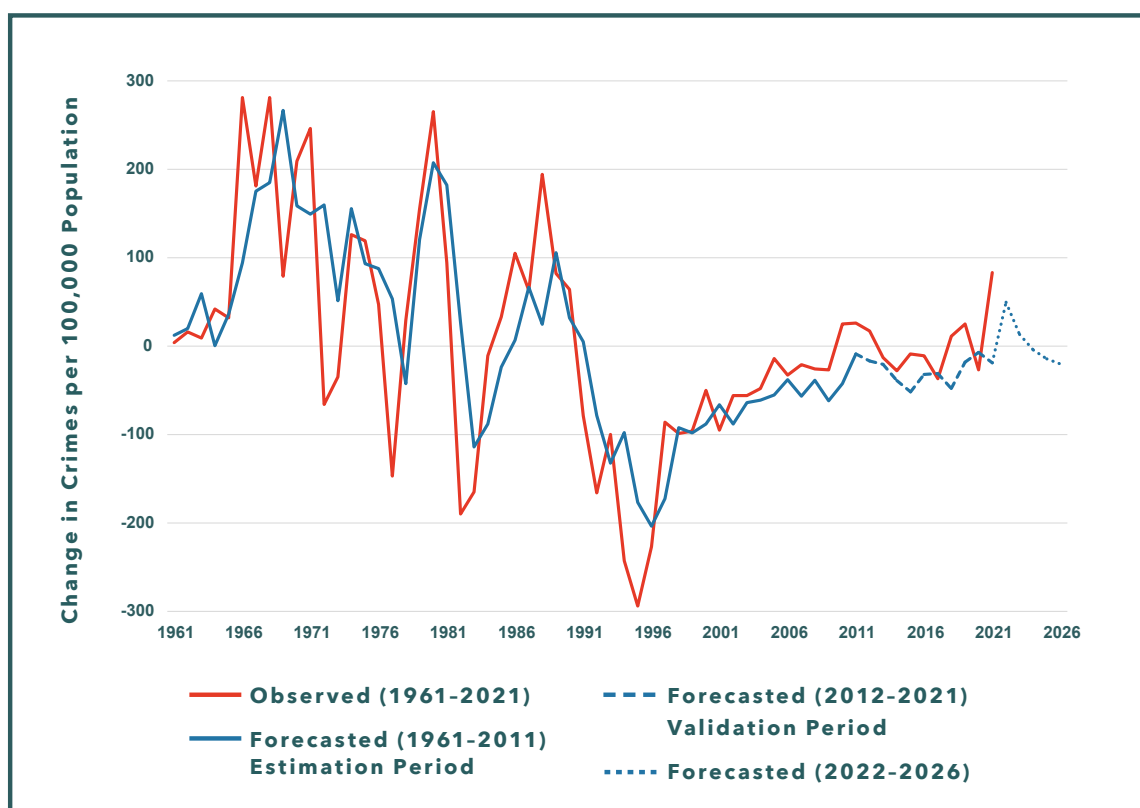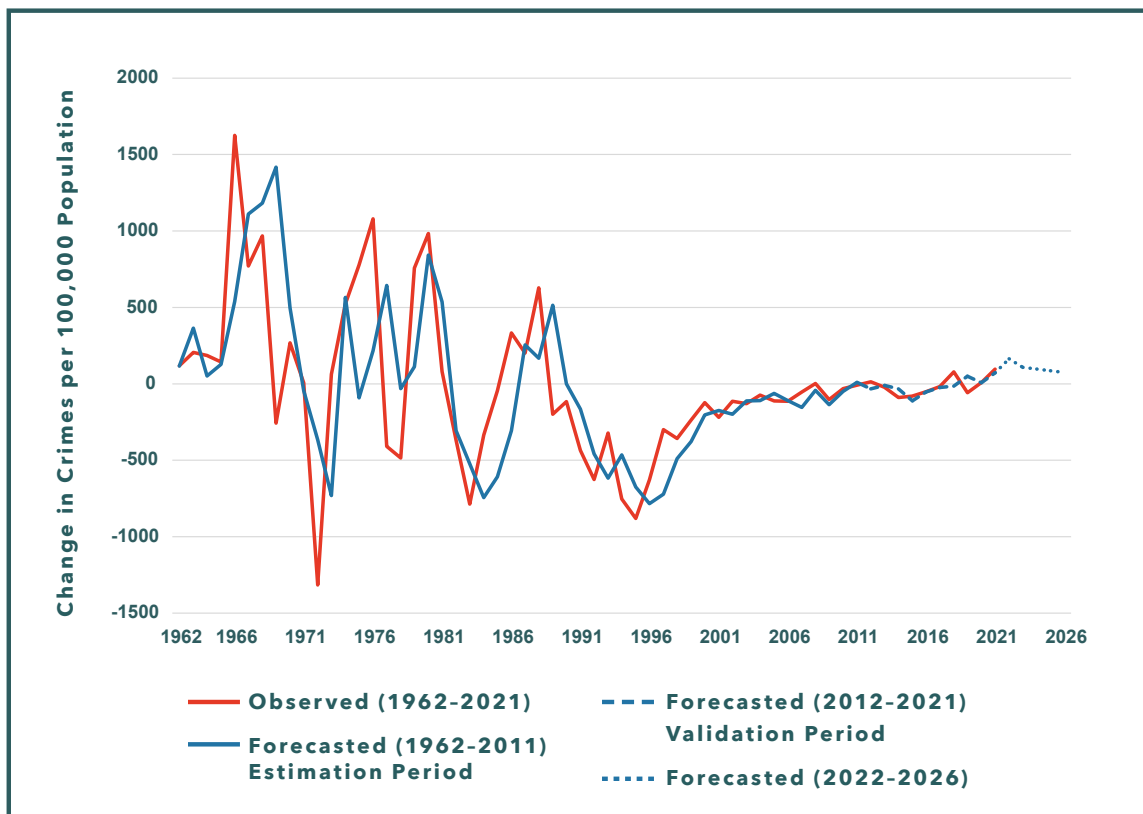

Source: FBI's Uniform Crime Reports.

Figure 1 displays the observed and forecasted annual changes in violent crime. The observed changes, denoted by the red line, extend from 1961 (the first difference from 1960) to 2021. The in-sample forecasted changes through 2011 are denoted by the solid blue line, and the dashed blue line represents the forecasted changes during the 2012–2021 out-of-sample validation period. The dotted blue line represents the forecasted changes in the violent crime rate between 2022 and 2026.

The forecasted changes in violent crime correspond closely to the observed changes, during both the 1961–2011 estimation period and the 2012–2021 validation period, with two exceptions, 2018 and 2021, which are discussed below. The results suggest that New York City's violent crime rate will increase in 2022 and 2023 and then fall through 2026.

The observed and forecasted changes in property crime, shown in Figure 2, are also very close. The results suggest that the property crime rate will increase, though at a declining rate, through 2026. These increases are expected to be very modest.

FIGURE 2. OBSERVED AND FORECASTED YEAR-OVER-YEAR CHANGE IN NEW YORK CITY PROPERTY CRIME RATE, 1962-2026

Source: FBI's Uniform Crime Reports.

Forecasts of an unknowable future will always contain error. This means that the policymaker will have to decide how much forecast error is tolerable, which is a substantive and not a statistical decision. We will assume for current purposes that forecasted crime rates that diverge from the observed rates by no more than 10% are sufficiently accurate and precise for both policy and theory evaluation. A forecasted annual rate that fell outside of these limits would be uninformative and suggest that the forecast model needed to be revised.

Appendix Table A displays the observed and forecasted crime rates during the validation period. The rates were computed by adding each year's change in the crime rate to the rate of the previous year. Averaged over the ten years of the validation period, the forecast error for violent crime—the difference between the observed and forecasted rates in either direction—is within the 10% tolerance limits. The mean absolute error during the validation period is 5.8%. There are two exceptions, 2018 and 2021, when the forecast errors are -10.75% and -16.19%, respectively. In both years, the forecasted violent crime rate falls below the observed rate. The divergence in 2018 is just outside the 10% tolerance limit and could be viewed as acceptable, if treated with caution. The error in 2021, however, would be viewed as unacceptably large. The observed violent crime rate rose by 15.2% between 2020 and 2021, from 547 to 630 violent crimes per 100,000 population. By contrast, the forecasted 2021 rate fell by 6.7% from the forecasted rate in 2020 (from 566 to 528 per 100,000) and by 3.5% from the observed 2020 rate (from 547 to 528 per 100,000).

An unanticipated 15% rise in the violent crime rate would have caught policymakers and law enforcement officials off guard, had they relied for planning purposes on a crime forecasting model such as the one used here. But our model does capture the rise in property crime that occurred between 2020 and 2021, when New York City's property crime rate increased by 6.6%, while the forecasted rate increased by 4.9%. In general, all of the errors for the property crime rate during the 10-year validation period fall within the 10% tolerance limits, and the mean absolute error during the validation period is just 2.4%.

As shown in Appendix Table A, our model forecasts a rise in New York City's violent crime rate in 2022, a smaller rise in 2023, and small declines during the following three years. The model forecasts increases in New York City's property crime rate between 2022 and 2026, with the

largest rise in 2022 (8.8% over 2021) and smaller increases each year from 2023 to 2026. With the exception of the unforecasted increase in violent crime in 2021, the small size of the forecast errors during the validation period inspire confidence in the violent and property crime forecasts for 2022 to 2026.

We cannot be certain, of course, that our forecasts will be sufficiently accurate and precise to serve as reliable policy guides, and policymakers may choose to set more restrictive tolerance limits around the forecast errors than the illustrative 10% limits we have used. Our results suggest, however, that New York City is unlikely to experience large and sustained crime increases during the next several years. The results also suggest that the sizable increase in violent crime in 2021 was a temporary fluctuation brought about by extraordinary and time-limited circumstances and not a harbinger of a new long-term steady state. As of this writing, the disruptive consequences of the pandemic have wound down, and social unrest of the intensity and scale seen in 2020 and 2021 has not returned. But the last few years serve as a reminder that crime rates are subject to unanticipated jolts that can throw off even the most reliable predictions of the future.[4]

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4 It should be noted that although the aggregate rate of violent crime declined in New York in 2020, the city saw an increase in homicide of unprecedented size, a local instance of the sharp rise in homicides in the nation as a whole. Despite this spike, the violent crime rate declined because homicides are rare compared to the other crime categories that figure in the violent crime rate.

The Impact on New York City Crime Rates of Reducing the Prison Population

We have suggested that the policy relevance of any statistical model depends on whether the elements of the model are, in fact, modifiable by policy. The size of the prison population is clearly a modifiable policy outcome. It can be reduced by altering the policies that determine prison admissions and the sentencing and parole policies that regulate length of stay and releases. Such proposals, however, invariably run up against concerns that reducing the incarcerated population will increase crime. These concerns are not unreasonable. We would not have included imprisonment rates in our forecasting model if we believed they had no impact on crime rates. But the size of this impact is an empirical question that continues to occupy researchers.

Suppose that in 2021, state policymakers had decided to reduce New York's imprisonment rate (which has been declining for over two decades) by an *additional* 25%? What impact would such a reduction have on New York City crime rates? We assume that a reduction in imprisonment of this magnitude would not occur in a single year but would unfold in a five-year planned decline. This time frame is realistic, and it has the added benefit of providing ample time for policymakers and criminal justice officials to make midcourse corrections as needed.

Figure 3 compares two forecasts of New York City's violent crime rate between 2022 and 2026: the original forecast, as shown in Appendix Table A, and the forecast assuming an additional 25% reduction in the imprisonment rate over those five years. The other variables in the model remained at their forecasted values.[5]

The reduction in the state imprisonment rate would have a very small effect on New York City's violent crime rate between 2022 and 2026, ranging from no effect in 2022 to just a 1.2% increase in the violent crime rate in 2026. But there are reasons to believe that even this very small expected crime increase is an overestimate. First, this exercise assumes that the total prison population is reduced by 25%. The policy change, however, would almost certainly be more selective, for example by limiting early release from prison to older inmates and others at relatively low risk of reoffending.

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5 We do not present comparable results for property crime because the imprisonment rate is not statistically significant in the property crime model and has no discernible impact on the property crime rate, with or without the additional reduction in imprisonment.

FIGURE 3. NEW YORK CITY VIOLENT CRIME RATE FORECASTS, WITH AND WITHOUT 25% IMPRISONMENT REDUCTION, 2022-2026
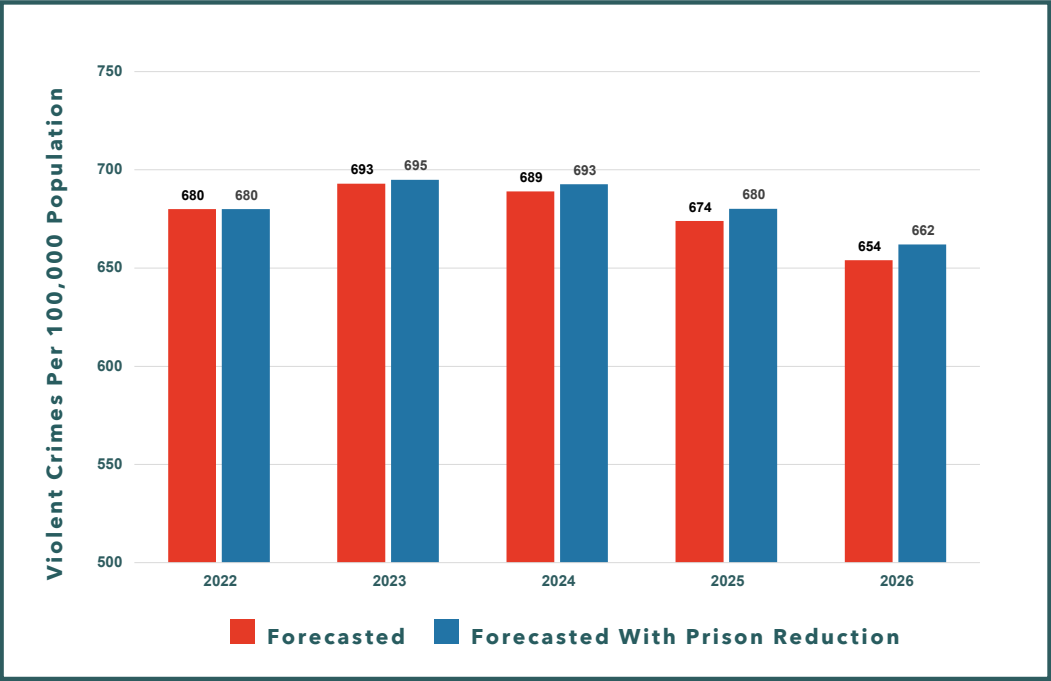
Second, the exercise assumes that no more provision would be made than in past practice to monitor or assist those who would be released from prison, which seems unlikely. Conscientious reform proposals should call for additional community supervision as an alternative to incarceration as well as increases in vocational training, job placement, and mental health and substance abuse treatment for releasees. A responsible approach to decarceration would implement evidence-based forms of supervision and support at the same time.

Conclusion

Policymakers have a strong interest in knowing whether crime rates are likely to increase or decline over the near term, the typical planning horizon for crime-control policies. Knowledge to guide policymaking is especially relevant at the state and local level, where crime policy is most often enacted in the United States. Our assessment of crime trends in New York City, based on a parsimonious and robust forecasting model, suggests that the violent crime rate will increase in 2022 and 2023 and then begin to decline and that the property crime rate will exhibit small increases through 2026. These increases will be driven by an escalating cost of living, though this is expected to moderate over the next few years. Our analysis suggests that policymakers could pursue a sizable reduction in the state prison population without producing notable increases in crime. To reduce the impact of decarceration on crime, it should be measured, take place over a period of years, and be counterbalanced by enhanced community-based monitoring and support.

The hazards of predicting the future of crime are obvious, even when the predictions are based on a reliable statistical model of past crime trends. Some conditions affecting crime rates, such as the aging of the population, can be forecasted with reasonable accuracy. But many others cannot. No one to our knowledge predicted the coronavirus pandemic, George Floyd's murder and the ensuing period of widespread social unrest, or the momentous recent increase in inflation. While we have assumed that the effects of the COVID-19 pandemic on crime rates were temporary, it is possible that it could have lingering or even permanent effects in the form of educational deficits resulting from school closures and online instruction or changes in population mobility as more people choose to work from home. It would be a mistake to discount the possibility of another inflammatory episode of police violence and social unrest. And, despite optimistic forecasts, the pace at which the current spike in inflation will subside remains uncertain. The lesson is to proceed cautiously, acknowledge the error that accompanies all forecasts, and decide how much error is acceptable for policy planning and evaluation. Most important, predicting the future of crime should be based on models that are continuously recalibrated to take account of new information and of the variation in local conditions to which crime policy must respond.

Appendix: Forecast Methods and Models

Testing the Crime Series for Stationarity

Two formal tests were conducted to determine whether the violent and property crime time series contain a unit root (i.e., are nonstationary). Both the augmented Dickey–Fuller (ADF) test and the Phillips–Perron (PP) test failed to reject the null hypothesis of a unit root for both series. US violent and property crime rates between 1960 and 2011 are nonstationary and conform to a random walk. The two series were therefore converted to first differences and the same tests were conducted. The tests revealed that both series are stationary in first differences.

ARIMA Models and Forecasting Results

ARIMA models estimate the autoregressive (denoted p), differencing (denoted d), and moving average (denoted q) properties of a time series. Several multivariate ARIMA(p,d,q) models containing the income-adjusted inflation rate and the imprisonment rate were estimated on the first-differenced crime rates. The models that minimized the mean-squared errors and mean absolute errors of the estimates for both the estimation period (1960–2011) and validation period (2012–2021) of the time series were retained. These models were then used to forecast New York City's violent and property crime rates for 2022 to 2026.

In Table A, the year-to-year forecasted changes in New York's violent and property crime rate are added to the previous year's rates to generate forecasts of the current year's rates during the validation period. The best-fitting forecast model for violent crime is an ARIMA(1,0,0) model, which contains a first-order autoregressive term in addition to the substantive covariates. The model forecasts violent crime rates during the 2012–2021 validation period that diverge in either direction from the observed rates by an average of 5.8%. The largest divergence is in 2021. The forecasted violent crime rate is 16.2% lower than the observed rate in that year. The forecasts through 2026 suggest that violent crime rates will increase in 2022 and 2023 and then fall through 2026.

	Violent Crime (ARIMA$_{(1,0,0)}$)			Property Crime (ARIMA$_{(2,1,0)}$)		
	Observed Rate	Forecasted Rate	Percentage Error	Observed Rate	Forecasted Rate	Percentage Error
	Validation Period					
2012	636	620	-5.35%	1712	1666	-2.69%
2013	623	615	-1.28%	1689	1702	-.77%
2014	595	584	-1.85%	1599	1657	3.63%
2015	586	544	-7.17%	1519	1488	-2.04%
2016	575	554	-3.65%	1467	1465	-.14%
2017	538	544	1.12%	1448	1444	-.28%
2018	549	490	-10.75%	1525	1433	-6.03%
2019	574	531	-7.49%	1467	1574	7.29%
2020	547	566	3.47%	1475	1474	-.07%
2021	630	528	-16.19%	1572	1547	-1.59%
MAPE[1]			5.83%			2.45%
2022		680			1710	
2023		693			1817	
2024		689			1913	
2025		674			1998	
2026		654			2072	

MAPE[1] = Mean absolute percentage error

The best-fitting forecast model for property crime is an ARIMA(2,1,0) model that contains first- and second-order autoregressive terms in first differences in addition to the substantive covariates. None of the forecasted property crime rates diverge from the observed rates by more than 7.3% during the validation period, and the average divergence is 2.4%. The forecasts indicate rising property crime rates through 2026, with the largest increase in 2022 and smaller increases thereafter.

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