Exploring the Effect of 2019-nCoV Containment Policies on Crime: The Case of Los Angeles

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Abstract
The global spread of 2019-nCoV, a new virus belonging to the coronavirus family, forced national and local governments to apply different sets of measures aimed at containing the outbreak. Los Angeles has been one of the first cities in the United States to declare the state of emergency on March 4th, progressively issuing stronger policies involving (among the others) social distancing, the prohibition of crowded private and public gatherings and closure of leisure premises. These interventions highly disrupt and modify daily activities and habits, urban mobility and micro-level interactions between citizens. One of the many social phenomena that could be influenced by such measures is crime. Exploiting public data on crime in Los Angeles, and relying on routine activity and pattern theories of crime, this work investigates whether and how new coronavirus containment policies have an impact on crime trends in a metropolis. The article specifically focuses on eight urban crime categories, daily monitored from January 1st 2017 to March 16th 2020. The analyses will be updated bi-weekly to dynamically assess the short- and medium-term effects of these interventions to shed light on how crime adapts to such structural modification of the environment. Finally, policy implications are also discussed.

Keywords: Coronavirus; Bayesian Modelling; Social Distancing; Urban Crime; Causal Impact; Time-Series; Routine Activity Theory; Crime Pattern Theory
Introduction

On December 31st 2020, China alerted the World Health Organization (WHO) to several cases of unusual pneumonia in Wuhan, a port city of 11 million people in the central Hubei province. The pneumonia was apparently caused by an unknown virus. Several of those infected had orbited around the local seafood wholesale market, which was shut down on January 1. On January 7th, a new virus, named 2019-nCoV, was identified and classified as belonging to the coronavirus family, which includes the common cold. On January 11th, China announced its first death from an illness caused by the new virus, a 61-year-old man who had purchased goods from the Wuhan’s seafood market. The treatment did not improve his symptoms after he was admitted to hospital and he died of heart failure on January 9th. On January 13th, the WHO reported a case in Thailand, the first outside of China, in a passenger who had arrived there from Wuhan. On January 19th, a 35-year-old man presented to an urgent care clinic in Snohomish County, Washington; he was the first case of 2019-nCoV infection confirmed in the United States (Holshue et al., 2020). On January 30th, the WHO declared 2019-nCoV a global health emergency as 7,711 cases were reported in the sole China, where the virus had spread to all 31 provinces. On February 14th, French authorities announced the first 2019-nCoV-related death in Europe; in the meanwhile, countries in Sub-Saharan Africa and Latin America were reporting their first coronavirus cases. On February 29th, the United States recorded its first 2019-nCoV death and announced travel restrictions.

Coronaviruses are common and spread through being in proximity to an infected person and inhaling droplets generated when an infected person coughs or sneezes, or touching a surface where these droplets land and then touching one’s face or nose. 2019-nCoV resulted to spread particularly easily and without stopping (Wu and McGoogan, 2020). In an attempt to limit the impact of the 2019-nCoV, governments of the world started to adopt containment or mitigation strategies (Wilder-Smith and Freedman, 2020). Aiming to reduce the picks of stress on healthcare systems, rulers promoted and enforced social distancing measures—i.e., avoiding close contact with others—, which include limiting large groups of people coming together (e.g., workplaces and schools), closing gathering places (e.g., shops, restaurants, and stations) and canceling private and public events (e.g., funerals, music festivals and sporting events). By the first two
weeks of March, several countries and regions of the world had adopted social distancing measures. These measures impact considerably on citizens and communities.

Distancing measures simultaneously affect the daily routines and the social interactions of millions of people. Daily commuters are forced to spend their days at home; household members share the same living spaces throughout the entire day; people cannot connect to their peers in person, but only telematically. Yet, the impact of the lock-down policies and the virus itself outreach the alteration of people’s daily routines and social relations. Restrictions on national and international movements of people and—to a lesser extent—goods, together with the emergent needs of a sick population, alter both demand and supply of goods. In the medium term, the losses due to the slowdown of the economic system may transform in higher unemployment and destitution for many. The scale social distancing and lock-down policies adopted to mitigate the deadly consequences of the 2019-nCoV constitute an unprecedented instrument to investigate contemporary societies.

Despite the attention of scientists in assessing social and psychological consequences of quarantine during public health emergencies as epidemics and pandemics, to date no research exists that investigates the effects of these measures on criminal activities. Several newspapers have already started to report and describe micro-level short-term changing patterns in criminal activity (Dodd and Stewart, 2020; Russell, 2020; Poston, 2020; Newall, 2020). This work attempts to address this gap, scientifically investigating the extent to which policy measures taken to contain 2019-nCoV coronavirus have significant effects on several urban crimes in the city of Los Angeles. Specifically, we concentrate on a set of urban crimes, namely battery (simple assault), vehicle theft, burglary, intimate partner assault, assault with deadly weapon, robbery, shoplifting, and theft. We do it by exploiting the discontinuity introduced by the adoption of the social distancing requirements in Los Angeles County—more than 10 million residents—in response to the local and public health emergency caused by the spread of the 2019-nCoV.

The relevance of this work lies in the importance of investigating whether and how these major societal modifications to the lives of millions of people influence urban crime occurrence. Specifically, it is crucial to understand what types of crime, if any, are mostly influenced by the forced modification of daily habits and behaviors. This exercise
will help in explaining what are the main changes that are plausible to foresee in these situations and what may be the underlying factors that lead to trend variations. Social distancing and quarantine inherently modify micro- and meso-level human interactions within an urban setting, increasing or decreasing criminal opportunities based on newly adopted behaviors as well as new criminal motivations. The modi operandi and the hotspots for crime are likely to change too. Theoretical implications of the results obtained are numerous due to the extent of transformations introduced by these policies and the novelty of the research proposed. Shedding light on these potential mechanisms can also help in theoretical advancing and in providing law enforcement agencies with indications regarding new threats and patterns in urban criminal activity. Minimizing uncertainty in the face of emerging or persistent crime patterns provides an effective response to these challenges.

The rest of the paper develops around the following structure. Section 1 highlights the gap of knowledge specifically addressed by this study and frames it within the criminological theoretical debate. Section 2 then justifies the use of the 2019-nCoV emergency to answer to our research question and outlines the adopted methodology and the data used for the analyses. Section 3 presents then the statistical outcomes for the selected crime categories and the overall number of crimes in the city of Los Angeles. The models show, so far, a significant decrease in robberies (-23%/−24%), shoplifting (-14%/−15%) and thefts (-9.1%/−9.6%). Furthermore, the overall trend of crimes in the city of Los Angeles exhibit a reduction (-5.4%/−5.6%) Finally, section 4 reviews the most important results of the analyses, focusing on the future expected patterns and the most important policy implications entailed by the study.

1 Research Background

1.1 Related Work

Recent history has been marked by the outbreak of several pandemics that considerably affected the world’s population to different extents. In 1918, the so-called “Spanish Flu” was a H1N1 influenza virus that infected about 27% of the world’s population up for an almost three-year period, with death estimates ranging from 17 to 50 million globally
In 1957, a new influenza denominated “Asian Flu”, led to a total of 1.1 million deaths worldwide. In 1968, another A (H3N2) influenza shocked the world, causing another estimate of 1 million deaths at the global level, particularly targeting people aged 65 years and older. In 2002, a severe acute respiratory syndrome coronavirus—i.e., SARS-CoV—emerged in China. During the period of infection, between November 2002 and July 2003, there were 8,098 reported cases of SARS and 774 deaths. Finally, in 2009 a novel A/H1N1 influenza virus emerged from the United States and spread quickly all over the world with an estimate of about 61 million cases in the United States alone from April 2009 to April 2010; this virus strain was commonly known as “Swine Flu”.

On March 11th, the WHO declared 2019-nCoV a global pandemic as the virus spread widely across continents, leading to a dramatic increase in the number of positive cases and deaths. As the virus first originated in China and rapidly diffused across Asia and then Europe, the Americas, and Africa, countries experienced delayed contagion patterns and, consequently, started to react with policies and interventions at different periods (Wilder-Smith and Freedman, 2020). At this point, most countries have already implemented (or are moving towards) policies that encompass social distancing as the most promising countermeasure to slow down the diffusion of the virus, as to protect their citizens and safeguard public health systems from collapse due to exponential or nearly-exponential increase of cases country-wise. As governments issue new directives, regulations, and recommendations to their citizens to proactively respond to the virus, cities, and communities, are progressively experiencing consistent changes in the way in which daily life occurs. Social distancing, as the most relevant strategy, clearly affects the way in which society behaves, impacting collective socialization, jobs, mobility, and the economy.

Regardless of the specific policies, public health emergencies consistently modify and influence many components of human society. In the past, researchers investigated these changes from different standpoints, analyzing the consequences of pandemics or other major epidemics. Economic accounts of such phenomena are among the most discussed strands of research. Brainerd and Siegler (2003) investigated the impact of the Spanish Flu on the United States in the period 1919-1930, showing a strong positive effect of the influenza pandemic on per capita income growth. The same question
was explored by Karlsson et al. (2014) focusing on economic performance in Sweden. HIV/AIDS epidemic has marked debates all over the world in the second half of the Twentieth century. In connection to its impact, several scholars analyzed its effect on economies all over the world (Bloom and Mahal, 1997; Dixon, 2002; McDonald and Roberts, 2006). Similar research has addressed the economic effects of other epidemic and pandemic outbreaks, including Avian flu (Kuo et al., 2009; Lean and Smyth, 2009), SARS (Hai et al., 2004; Gupta et al., 2005; Keogh-Brown and Smith, 2008) and Swine Flu (Page et al., 2012).

Scholars have not solely focused on the economic impact of large epidemics and pandemics. Given the manifold consequences posed to society, researchers have also focused on the characteristics of policy-making, politics and international responses to such public health international and global crises. Notable works in this area targeted the historical study of tuberculosis, investigating the role of segregation of infected individuals and the eradication of bovine tuberculosis (Fairchild and Oppenheimer, 1998), the responsiveness of disease surveillance at the international level in tackling Avian influenza (Scoones, 2010), the need for a more resilient and sustainable society, in the aftermath of the Ebola outbreak in West Africa (Heymann et al., 2015), and also the study of political agendas and comparative measures to fight HIV/AIDS (Boone and Batsell, 2001; Lieberman, 2007).

Several studies have also analyzed the social implications of epidemics and pandemics. Among these implications, population’s perception of the risks related to an epidemic is strongly relevant in understanding the effectiveness of containment and prevention policies and the medium- and long-range effects of a viral disease within a community. Helleringer and Kohler (2005) studied how social interactions can be relevant to shape risk perceptions in the context of HIV/AIDS increasing individual awareness, by investigating spousal communication about the epidemic in rural Malawi. Smith (2006), instead, proposed to re-evaluate the importance of risk perception and communication as a strong instrument to reduce the negative effects of future epidemic and pandemic outbreaks, relying on the scrutiny of the processes related to SARS. Another line of research, instead, aimed at assessing the psycho-social effects of pandemics. Many studies, in this regard, have attempted to delineate and analyze the social and psychological effects of HIV/AIDS in different regions of the world (Keogh et al., 1994;
Danziger, 1994; Barnett et al., 2000; Piot et al., 2001; McDowell and Serovich, 2007; Subramanian et al., 2009). More recently, scholars have also devoted efforts to highlight psycho-social mechanisms related to the massive Ebola epidemic that hit Western Africa from 2013 to 2016. Relying on an ethnographic research design, Pellecchia et al. (2015) demonstrated how the epidemic reinforced condemnation, stigmatization and socio-economic distress of Liberian citizens. Similarly, Van Bortel et al. (2016) studied the main negative psychological outcomes of the Ebola outbreak, showing that individuals affected by the disease were likely to lead to stigmatization, to feel guilty, and to loss of truth in health services.

Finally, an area of scientific inquiry related to the present article pertains to the psychological investigation of the effects of quarantine on individuals. Besides being infected, scientists have evaluated the impact of self-isolation on the mental health of individuals living in areas particularly hit by infective diseases (Maunder et al., 2003; Wang et al., 2011; Rubin and Wessely, 2020). In a recent article, Brooks et al. (2020) conducted a review finding acute stress disorder, post-traumatic stress, high depressive symptoms, anxiety, anger, alcohol abuse or dependence among the most significant negative psychological effects of quarantine. Additionally, the study listed several specific stressors during quarantine comprising the duration of the quarantine itself, the fear of infection, frustration and boredom, and inadequate supply of basic commodities, services, and information.

The literature indeed shows how policies aimed at imposing social distancing as a cornerstone intervention to limit a disease outbreak directly modify people’s behaviors, attitudes, and psychological conditions at the micro-level, opening unanswered questions related to the criminological consequences of these measures. Besides few studies focusing on the relation between SARS and suicides in Hong Kong (Chan et al., 2006; Cheung et al., 2008), and despite the relevance of the topic, scientists have not yet answered questions related to the possible consequences of quarantine, social distancing, and self-isolation on crime and deviant trends, failing thus to provide empirical assessments on whether and how criminal behavior evolves in periods of epidemics or pandemics outbreaks.

It is worth clarifying that suicide can be considered as a form of deviance, but it is not criminalized in Hong Kong.
1.2 Theoretical Framework

Whether we do not have an understanding of the effects of pandemics and massive social distancing measures, structured theories of urban criminality help us in hypothesizing possible future scenarios. Routine activity (Cohen and Felson, 1979) and crime pattern theories (Brantingham and Brantingham, 1984) outline how the characteristics and interactions of individual-level activities command the spatial and temporal distribution of offending and victimization. Assuming these perspectives, members of a community can be modeled as potential offenders, potential victims, and potential guardians, moving around and interacting in a socio-geographical space. Moving from these premises, routine activity theory postulates that offenders and victims (or targets) usually meet during daily, non-criminal activities (Brantingham and Brantingham, 1984). Behavioral decisions then determine how the various agents react to each other’s presence and actions. Crime occurs in the context of the everyday routines as the three factors converge in space and time: a motivated offender, a victim or potential target, and the absence of a capable guardian (Brantingham and Brantingham, 1984).

Nowadays, many crime studies, especially those on volume and urban crimes, rely on ideas emerging from theories that focus on situations and opportunities as triggers of crime (Cohen and Felson, 1979; Brantingham and Brantingham, 1981; Birkbeck and LaFree, 1993; Brantingham and Brantingham, 1995; Clarke, 1995; Wortley et al., 2008; Clarke, 2009). Because of the strong attention these theories pose to ordinary interaction in the geographical and social space, we also rely on them to formulate our hypotheses on the short-term impact of the 2019-nCoV-related social distancing measures.

On March 4\textsuperscript{th}, six new cases of 2019-nCoV were confirmed in Los Angeles County; rising the total number of cases for the county up to seven. Following this, the Los Angeles County Board of Supervisors and the Department of Public Health declared a health emergency. From that moment on, the Los Angeles population had been invited to adopt simple social distancing strategies that limit their exposure to others—e.g., remaining home when sick—and to prepare for the possibility of more significant social distancing requirements. It is March 16\textsuperscript{th}, when more stringent measures were adopted. The County Health Officer prohibited all indoor and outdoor, public and private events...
and gatherings within a confined space, where fifty or more people are expected to
attend at the same time, to require social distancing measures and temporary closure
of businesses where patrons stay in contact with each other for extended periods of
time, such as, movie theaters, gyms and fitness centers, arcades, bowling alleys, bars
and nightclubs that do not serve food. On March 19th, the California Department of
Public Health ordered all individuals living in California to stay home (County of Los
Angeles, 2020).

All in all, these measures cause people to spend more time at home and to loosen
the density of social interactions. Accordingly, crime opportunities and places where
crimes occur are likely to change drastically from past observations and experiences. In
response to social distancing, in the short run, we can expect a contraction in most urban
crimes as victim (or target) density reduces in many areas of the city (Angel, 1968). We
hypothesize crime reduction will be strong in crime generators areas, which we intend as
“particular areas to which large numbers of people are attracted for reasons unrelated
to any particular level of criminal motivation they might have or to any particular
crime they might end up committing” (Brantingham and Brantingham, 1995, p.7). In
Los Angeles, typical examples might include the Hollywood entertainment district, the
financial district with its high concentration of offices, and the famous Staple Center.
Also flows of people to some crime attractor areas are going to be reduced as people have
to avoid concentrating in bars, nightclubs, or shopping malls, but also in high-intensity
drug trafficking and prostitution areas.

To various extents, we foresee a reduction in the number of batteries, assaults with
deadly weapons, robberies, burglaries, shoplifting, thefts, and car thefts as a conse-
quence of a reduced interaction of people in the urban environment. We hypothesize
burglaries and shoplifting to reduce the most. There is an extensive agreement over the
fact that burglars prefer to target unoccupied homes (Mustaine, 1997; Shover, 1991;
Tseloni et al., 2002). People forced at home will guard their houses for longer hours
minimizing their exposure to burglaries. The reduction in the number of open shops and
the limitations in the number of entrances–only a certain amount of people are allowed
to be simultaneously in the shops depending on the premises’ square meters–reduce the
opportunities for crime by simultaneously increasing the guardianship and reducing the
exposure of targets to potential offenders. Conversely, intimate partner assaults are
likely to increase. Patriarchy and gender inequality are considered as the root causes of intimate partner violence; yet, situational determinants are also recognized to influence this form of crime (Wilkinson and Hamerschlag, 2005). As a consequence of the spread of 2019-nCoV, couples—including dysfunctional ones—spend more time together with reduced supervision of possible informal guardians as relatives and acquaintances, two factors that may lead to an increase in violence (Hayes, 2018).

Police’s attention to urban crimes may reduce, thus partially countering the crime mitigating effect driven by looser social interactions. Law enforcement agencies, indeed, are often required to enforce the emergency measures to contain the rapid spread of the virus. In this respect, it is paradigmatic the decision of the Philadelphia Police Department, which decided to delay arrests for several low-level criminal offenses due to the burden given by the 2019-nCoV situation (Newall, 2020). The reduction of police capabilities is likely to have an only marginal effect on intimate partner violence, which are serious crimes that take place in a private environment.

2 Analytical Framework

2.1 Methodology

Evaluating the causal link and impact of certain policies is a crucial aspect of research and practice. Criminologists have long attempted to evaluate the extent to which public policies aimed at reducing crime are actually effective in pursuing their mission. Populated areas of research are the evaluation of measures aimed at reducing street crime (Anglin et al., 1999), drug- and alcohol-related offenses (Strang et al., 2012; Humphreys et al., 2013), police practices (Braga, 2005; Braga et al., 2014, 2015), and gun violence (Ludwig and Cook, 2004).

The gold standard for assessing the causal impact of a certain intervention is represented by Randomized Controlled Trials (RCT) (Rubin, 1974). However, this research design is often unfeasible due to issues related to financial costs, ethics or practical obstacles (e.g., complex regulatory requirements). Also in the context of this work, it is impossible to imagine the possibility to design a meaningful and correct RCT to evaluate the extent to which a 2019-nCoV counter-policy would cause a change in criminal
trends. Three main reasons explain this impossibility in the scope of our analysis.

First, social distancing and self-isolation policies issued in Los Angeles apply to the entire city, thus making impossible to define a setting in which we compare the trends across treated and non-treated precincts or neighborhoods. Second, these policies are becoming universally applied to the entire country, making it impossible to use other American cities as controls. Third, even in the case in which only certain cities were affected by the restrictive measures, it would be difficult to compare criminal trends across treated and non-treated cities due to the potentially high number of unobserved factors determining the underlying trends associated to the different contexts.

While Pearl (2009) demonstrates that post-facto observational studies cannot provide any answer to the investigation of true causal inference due to the potential presence of confounding factors, several quasi-experimental alternatives have been proposed to overcome the impossibility to run RCT in certain scientific fields. Among these methods stands interrupted time series. Interrupted time series have gained popularity in sociology and criminology, and they have been applied to several different research problems (Biglan et al., 2000; Humphreys et al., 2013; Pridemore et al., 2013, 2014; Humphreys et al., 2017). This method allows assessing the effect of a certain policy analyzing the change in the level and slope of the time series after an intervention has been applied, compared to the structure of the temporal dynamic before the intervention. More recently, however, scientists have developed a framework for evaluating the causal influence of a certain intervention relying on Bayesian statistics.

Following this later evolution, this work specifically investigates the effect of social distancing and related measures in the attempt to contain 2019-nCoV on criminal trends in Los Angeles using Bayesian structural time-series (BSTS) models (Brodersen et al., 2015). As shown by the authors, BSTS are state-space models specifically defined by two equations. The first, i.e. the observation equation, being:

\[ y_t = Z_t^T \alpha_t + \varepsilon_t \]

where \( y_t \) is a scalar observation, \( Z_t \) is the \( d \)-dimensional output vector and \( \varepsilon_t \sim N(0, \sigma_t^2) \) and \( \varepsilon_t \) is a scalar observation error with noise variance \( \sigma_t \). The observation equation connects the observed data \( y_t \) to a latent \( d \)-dimensional state vector \( \alpha_t \). The second,
equation, instead is the state equation, which reads:

$$\alpha_{t+1} = T_t \alpha_t + R_t \eta_t$$

(2)

where $T_t$ is a $d \times d$ transition matrix, $R$ is a $d \times q$ control matrix, $\eta_t$ is a $q$-dimensional systems error with a $q \times q$ state diffusion matrix $Q_t$ such that $\eta_t \sim \mathcal{N}(0, Q_t)$. This second equation specifically governs the dynamic change of the state vector $\alpha_t$ through time. The inferential dimension in the model comprises three components. First, draws of the model parameters $\theta$ and the state vector $\alpha$ (given $y_{1:n}$, i.e. the observed data in the training period) are simulated. Second, the model uses posterior simulations to simulate from $p(\tilde{y}_{n+1:m} \mid y_{1:n})$, which is the posterior predictive distribution, with $\tilde{y}_{n+1:m}$ as the counterfactual time series and $y_{1:n}$ as the observed time series before the intervention. Third, using posterior predictive samples, the model compute the posterior distribution of the point-wise impact $y_t - \tilde{y}_t$ for each time unit $t$.

### 2.2 Data

To conduct our analysis, we have first relied upon the Los Angeles Open Data portal (https://data.lacity.org). Exploiting the website dedicated API, we have downloaded data on reported crimes in Los Angeles from two different datasets. The first one comprises all crime incidents reported from 2010 to 2019. The second one, instead, contains all the crimes reported from January 1st, 2020, and it is updated weekly online with new information. These two datasets contain detailed daily observations regarding each reported crime with information on the type of offense, the age, gender and descent of the victim (if any), the type of weapon (if any), and the location of the occurrence. For the scope of the present work, we have only relied on the type of offense as a meaningful source to analyze city-wide criminal trends. A brief description of the three datasets (the one comprising crimes from 2010 to 2019, the one weekly updated with offenses from 2020 on, and the resulting merged one that has been used in the models) is provided in Table 1.
We have retrieved data filtering by the date of reporting, we have extracted the crime categories of interest and we have then grouped observations by daily counts, obtaining separated time series for each crime category. Figure 1 displays the number of observations per crime category in the period currently under consideration, going from January 1\textsuperscript{st} 2017 to March 16\textsuperscript{th} 2020.

![Figure 1: Number of Observations per Crime Category](image)

Furthermore, to get controls we have used two additional datasets. The first one is an open-access dataset provided by the governmental site of the National Centers for Environmental Information (https://www.ncdc.noaa.gov) with data on minimum, average and maximum temperature daily registered at the Los Angeles Airport in the
timeframe of interest. The second one is a publicly available dataset containing American holidays. These two additional datasets are used to include controls in our analyses, as the literature has long found relationships between temperature and variation in crime trends (Cohn, 1990; Field, 1992) and between festivities and holidays and criminal temporal clustering (Cohn and Rotton, 2003; Towers et al., 2018). Furthermore, as requested by the method, these two covariates have not been affected by policies. This is trivial in the case of average temperature, while holidays may be affected in the future if restrictions will be prolonged for months. It is worth noting that this method generally recommends using more than two controls to evaluate the effect of an intervention on the response time series. However, in our research design, we assume that it is highly unlikely that any other daily predictor of crime in Los Angeles left out from this analysis has been influenced by the issued containment policies. The decision to exploit time series spanning more than three years has been made to reduce the potential biases arising from the exclusion of hidden trend dynamics, preserving the seasonality and long-term dependencies of crime as a complex social phenomenon. Table 2 reports the main descriptive statistics for the time series that are part of the analysis.

| Variable                     | Min   | 1st Q | Median | Mean  | St. Dev. | 3rd Q | Max   |
|------------------------------|-------|-------|--------|-------|----------|-------|-------|
| All Crimes                   | 337.00| 572.00| 629.00 | 621.00| 66.900   | 669.00| 796.00|
| Assault (with Deadly Weapon) | 6.00  | 24.00 | 29.00  | 29.55 | 7.48     | 34.75 | 61.00 |
| Battery                      | 15.00 | 46.00 | 52.00  | 52.32 | 9.40     | 58.00 | 93.00 |
| Burglary                     | 13.00 | 31.00 | 38.00  | 38.78 | 9.95     | 45.00 | 93.00 |
| Intimate Partner Assault     | 18.00 | 36.00 | 41.00  | 41.64 | 8.83     | 47.00 | 78.00 |
| Robbery                      | 8.00  | 20.00 | 24.00  | 24.31 | 5.81     | 28.00 | 48.00 |
| Shoplifting                  | 2.00  | 15.00 | 18.00  | 18.10 | 4.84     | 21.75 | 33.00 |
| Theft                        | 21.00 | 53.00 | 63.00  | 62.03 | 13.10    | 71.00 | 104.00|
| Stolen Vehicle               | 19.00 | 40.00 | 47.00  | 46.75 | 9.38     | 52.00 | 88.00 |
| Holiday                      | 0.00  | 0.00  | 0.00   | 0.02  | 0.16     | 0.00  | 1.00  |
| Average Temperature          | 49.00 | 59.00 | 63.00  | 63.80 | 6.20     | 68.00 | 86.00 |

Table 2: Descriptive Statistics of the Considered Time Series
3 Results

This section presents the results of the causal impact of the policy intervention starting on March 4th per each offense type. Per each crime, the same analytical structure is provided. We run two different models. The first one is a univariate model that only considers the time series of interest without controls. The second model instead integrates two covariates as to control for spurious effects and unobservable dynamics. As anticipated before, these two covariates are the average daily temperature and the presence/absence of a holiday for each time point. Figure 2 shows the time series of all the considered crimes.

Assault with Deadly Weapons

An assault with a deadly weapon occurs when an individual attacks a victim through a physical attack conducted with a physical object that can seriously injure or even inflict dead. Depending on the circumstances, assault with a deadly weapon can be considered
either a felony or a misdemeanor. The most common types of deadly weapons are
guns, knives, but also other objects can be classified as deadly, like bottles, bats,
hammers, while generally hands and feet are not considered deadly. Table 3 reports the
outcomes of the analysis.

|                | Univariate | With Cov. |
|----------------|------------|-----------|
|                | Average    | Cumulative| Average | Cumulative |
| Actual         | 26         | 317       | 26      | 317        |
| Prediction (S.D.) | 27 (2.2)   | 327 (26.9)| 27 (2.2)| 327 (27.1) |
| 95% C.I.       | [23.32]    | [275, 379]| [23.31]| [274, 374] |
| Absolute Effect (S.D.) | -0.79 (2.2) | -9.50 (26.9) | -0.41 (2.3) | -4.89 (27.1) |
| 95% C.I.       | [-5.1, 3.5]| [-61.6, 42.2]| [-4.7, 3.6]| [-56.9, 43.1]|
| Relative Effect (S.D.) | -2.98% (8.2%) | -2.98% (8.2%) | -1.5% (8.4%) | -1.5% (8.4%) |
| 95% C.I.       | [-19%, 13%]| [-19%, 13%]| [-18%, 13%]| [-18%, 13%] |
| Posterior tail-area probability p: | 0.36409 | 0.48134 |
| Posterior prob. of a causal effect: | 64% | 52% |

Table 3: Causal Impact Analysis - Assaults with Deadly Weapons

Both models, i.e. the univariate and the multivariate ones, do not show any sta-
tistically significant effect of the containment policies on this offense in Los Angeles.
Although both report negative coefficient, indicating a reduction in the trend in ab-
solute and relative terms, the posterior probability of a causal effect are, respectively,
64% and 52%. Further analyses in the next weeks will be decisive in understanding
whether this negative effect is due to random fluctuations or if the impact will increase
the reduction trend, leading to a statistically significant outcome.

**Battery - Simple Assault**

Although these two offenses are coded as a single one in the original database, California
assault law, disciplined by Penal Code 240PC, provides two distinct definitions for
battery and assault. A simple assault is the attempt to use force or violence against
someone else, while battery is the actual use of force or violence against one or more
individuals. Results of the analyses are reported in Table 4.

\[2\text{In order to facilitate the reading, we clarify that in the present work we consider a causal effect to be significant when its probability is equal or higher than 95%.}\]
Table 4: Causal Impact Analysis - Battery (Simple Assault)

So far, containment policies do not seem to have resulted in a reduction of battery and simple assaults in the city of Los Angeles. Compared to the previous crime category (and the outcomes displayed in Table 3), the effect is not only non-significant (posterior probability of a causal effect is 58% in the univariate case and 59% in the multivariate one) but it also changes direction when the two models are compared. In fact, in the univariate case, the relative effect is -0.6%, while in the multivariate model the policies seem to increase crime by +0.78%. These discarding outcomes reinforce the absence of a clear and distinguishable effect.

Burglaries

In California, according to the Penal Code, burglary is defined as the act of entering any structure, room, or locked vehicle with the intention to commit a theft or a felony. Furthermore, an individual can be considered guilty of burglary even if the intended crime, once entered, is never been committed. Our initial hypothesis is that containment policies should have a clear impact on this crime category as people encouraged or forced to stay in their houses increase guardianship, thus reducing the chance for an individual to enter a property without being noticed. Table 5 shows statistical results for burglary.
Table 5: Causal Impact Analysis - Burglary

In spite of our hypothesis informed by the considered theoretical framework, the state of emergency declared by the city of Los Angeles and the related policies to contain the spread of 2019-nCoV have not yet produced any significant effect on burglaries. Similar to what happened for battery and simple assaults, the effects report diverging direction between the two models. The univariate model shows an increase of 0.89% with respect to the predicted value in absence of an intervention, while the multivariate displays an effect equal to -0.58%, with posterior probabilities respectively being 56% and 50%. The absence of an effect is likely related to the fact that data at our disposal (gathered on March 18th with observations updated up to March 16th) do not cover yet the period in which the City of Los Angeles has issued stricter rules to fight the virus, as the state order to stay at home.

Intimate Partner Assault

To properly analyze intimate partner assaults, we have combined both simple and aggravated assaults. These two offense fall under the broader set of domestic violence crimes. California Penal Code defines an intimate partner as a current or former spouse, a fiance, a co-parent of a child, a person with whom the perpetrator had a dating relationship or a person with whom the perpetrator lives. 2019-nCoV-containment policies, we hypothesize, could affect domestic violence as a consequence of the individuals’ forced higher amount of time spent at home in a potentially stressful situation.
### Table 6: Causal Impact Analysis - Intimate Partner Assault

|                  | Univariate | With Cov. |
|------------------|------------|-----------|
|                  | Average    | Cumulative| Average   | Cumulative |
| Actual           | 38         | 454       | 38        | 454        |
| Prediction (S.D.)| 39 (2.3)   | 473 (27.5)| 39 (2.1)  | 466 (25.3) |
| 95% C.I.         | [35, 44]   | [424, 529]| [34, 43]  | [414, 512] |
| Absolute Effect (S.D.) | -1.6 (2.3) | -18.8 (27.5) | -0.96 (2.1) | -11.52 (25.3) |
| 95% C.I.         | [-6.3, 2.5]| [-75.4, 30.3]| [-4.9, 3.4]| [-58.4, 40.2]|
| Relative Effect (S.D.) | -4% (5.8%) | -4% (5.8%) | -2.5% (5.4%) | -2.5% (5.4%) |
| 95% C.I.         | [-16%, 6.4%]| [-16%, 6.4%]| [-13%, 8.6%]| [-13%, 8.6%]|
| Posterior tail-area probability p: | 0.24535 | 0.37313 |
| Posterior prob. of a causal effect: | 75% | 63% |

Despite our hypothesis, Table 6 indicates that the policy has not prompted any significant change in intimate partner assault trends hitherto. Furthermore, the obtained effects are negative (-4% and -2.5%, respectively). The explanation behind the absence of a clear and significant signal in the post-intervention period may likely be connected to the post-intervention period being marked by mild policies that did not encompass the order of going out only for urgent or work-related matters. Potentially, the next statistical updates could show stronger (and statistically significant) coefficients, helping in better understanding the impact of social distancing and related interventions on these critical offenses.

**Robbery**

California Penal code defines the crime of robbery as the act of taking personal property from someone else, against the targeted victim’s will, using force or fear, classifying it as a felony. Table 7 provides the results of the statistical analysis related to this specific crime.
Table 7: Causal Impact Analysis - Robbery

In our selected sample of crime types, robbery is the first one to show a significant effect in the post-intervention period. This applies to both the univariate and the multivariate cases. In the univariate case, the relative effect is estimated in a reduction of 24% in robberies, with a cumulative total of 202 cases against a predicted 266 in a non-intervention scenario. In the multivariate case, the effect is slightly reduced (-23%), with a predicted cumulative value of 262. In the former case, reported model p-value is 0.00333, indicating a 99.67% probability of a causal effect, while in the latter the p-value is 0.00208, indicating a 99.79% probability. The magnitude of the effects is thus particularly high, suggesting that soft social distancing has an effect in decreasing robbery opportunities by reducing social interactions, crowded events and public gatherings. The progressive streets and public spaces emptying seems hence to lead to a substantial modification in the trends of robberies. Further updates will be crucial in understanding whether this pattern will be consistent and stable for a longer period.

**Shoplifting**

According to the California Penal Code, shoplifting is defined as the offense of entering a commercial establishment during business regular hours, with the intent of committing a theft crime worth $950 or less (regardless of the actual completion of the theft). In the present work, we have also considered shoplifting grand-thefts, related to attempted thefts of property worth more than 950$. 

|                  | Univariate |          |          | With Cov. |          |          |
|------------------|------------|----------|----------|-----------|----------|----------|
|                  | Average    | Cumulative | Average | Cumulative | Average | Cumulative |
| Actual           | 17         | 202      | 17       | 202      | 17       | 202      |
| Prediction (S.D.)| 22 (1.7)   | 266 (20.5) | 22 (1.6) | 262 (19.5) | 22 (1.6) | 262 (19.5) |
| 95% C.I.         | [19, 25]   | [225, 304] | [19, 25] | [225, 302] | [19, 25] | [225, 302] |
| Absolute Effect  | -5.3 (1.7) | -63.6 (20.5) | -5 (1.6) | -60 (19.5) | -5 (1.6) | -60 (19.5) |
| 95% C.I.         | [-8.5, -1.9] | [-101.8, -22.6] | [-8.3, -1.9] | [-100.1, -22.8] | [-8.3, -1.9] | [-100.1, -22.8] |
| Relative Effect  | -24% (7.7%) | -24% (7.7%) | -23% (7.5%) | -23% (7.5%) | -23% (7.5%) | -23% (7.5%) |
| 95% C.I.         | [-38%, -8.5%] | [-38%, -8.5%] | [-38%, -8.7%] | [-38%, -8.7%] | [-38%, -8.7%] | [-38%, -8.7%] |
| Posterior tail-area probability p: | 0.00333 | 0.00208 | 0.00333 | 0.00208 |
| Posterior prob. of a causal effect: | 99.67% | 99.79% | 99.67% | 99.79% |
Table 8: Causal Impact Analysis - Shoplifting

Table 8 displays the outcomes of the analysis performed for shoplifting. Shoplifting exhibits a significant reduction after the introduction of the state of the emergency due to the novel coronavirus outbreak in Los Angeles. The outcomes hold for both models. Against cumulative predicted values of 220 and 223 in virtual scenarios with no intervention for the univariate and multivariate cases respectively, the models show cumulative results equal to 189. This indicates an estimated relative reduction of 14% in the univariate case, and a 15% reduction in the multivariate one. The probability of the effects being a causal consequence of the policies is 95.64% and 97.19%, providing a quite strong statistical evidence. As hypothesized, this reduction can be determined by the decision of people to avoid public spaces, as shops or commercial malls and the presence of quota to the number of entrance. Furthermore, if these figures will be confirmed in the following weeks, the results can be integrated with the fact that many commercial establishment will be closed as a result of stricter interventions to enforce social distancing.

Theft

For the scope of the present work, we have combined in the general category “Theft” both petty thefts and grand thefts. California Penal Code defines petty theft as the act of stealing (or wrongfully taking) an object belonging to someone else when the value of the property is equal to $950 or less. Grand theft, instead, represents a more serious
offense and pertains acts in which the property has a value higher than 950$.

|                | Univariate | With Cov. |
|----------------|------------|-----------|
|                | Average    | Cumulative | Average | Cumulative |
| Actual         | 55         | 662       | 55      | 662        |
| Prediction (S.D.) | 61 (2.9)  | 728 (35.3) | 61 (2.8) | 732 (33.2) |
| 95% C.I.       | [55, 66]   | [658, 797]| [56, 67] | [670, 801] |
| Absolute Effect (S.D.) | -5.5 (2.9) | -66.1 (35.3) | -5.8 (2.8) | -70.0 (33.2) |
| 95% C.I.       | [-11, 0.34] | [-135, 4.13]| [-12, -0.64] | [-139, -7.67] |
| Relative Effect (S.D.) | -9.1% (4.8%) | -9.1% (4.8%) | -9.6% (4.5%) | -9.6% (4.5%) |
| 95% C.I.       | [-19%, 0.57%] | [-19%, 0.57%]| [-19%, -1%] | [-19%, -1%] |
| Posterior tail-area probability p: | 0.0333 | 0.01663 |
| Posterior prob. of a causal effect: | 96.67% | 98.33% |

Table 9: Causal Impact Analysis - Thefts

In line with what we have found for robbery and shoplifting, thefts also appeared to be affected by the application of the 2019-nCoV-related policy interventions. Both models show a sensible reduction of thefts in the city of Los Angeles, with a 9.1% decrease in the univariate case (significant at the 96.67% level) and a 9.6% reduction in the multivariate one (significant at the 98.33%). The cumulative number of thefts in the post-intervention period is 662, while the predicted values are 728 and 732 in the univariate and multivariate cases, accounting thus for less 66 and 70 thefts respectively.

Theft, robbery and shoplifting are three type of offenses involving a direct act targeting a property, thus making reasonable to think that a common underlying principles (e.g., reduced opportunities, increased guardianship) govern the similar trends for all three offenses. Only further analyses, however, will be able to confirm or provide more evidence to this speculation.

Stolen Vehicles

This category refers to two different offenses, namely grand theft auto and the unlawful taking or driving of a vehicle. The main difference between the two pertains the duration of the crime itself. If, for instance, a person steals a car with the intent to keep it, this is often considered grand theft auto. Conversely, if the offender aims at using the car for a ride (or, in any case, for a short timeframe), the act is usually considered as the
unlawful taking or driving of a vehicle. In the former case, the offense can be considered either a felony or a misdemeanor (depending on the circumstances), while in the latter the offense is generally classified as a misdemeanor.

|                | Univariate | With Cov. |
|----------------|------------|-----------|
| Actual         |   45       |   45      |
| Prediction (S.D.) | 44 (2.4)  | 45 (2.4)  |
| 95% C.I.       | [40, 49]   | [40, 49]  |
| Absolute Effect (S.D.) | 0.46 (2.4) | 0.029 (2.4) |
| 95% C.I.       | [-4.2, 4.9] | [-4.6, 4.4] |
| Relative Effect (S.D.) | 1% (5.4%) | 0.064% (5.4%) |
| 95% C.I.       | [-9.4%, 11%] | [-10%, 9.9%] |

Table 10: Causal Impact Analysis - Stolen Vehicles

Table 10 shows that, at this point, the policies have not yet led to any significant effect in the temporal trends related to stolen vehicles. Differently for the other non-significantly affected crime categories, the relative effects are extremely low for both models (1% in the univariate case, 0.064% in the multivariate one). It will be necessary thus to wait for updated data and additional analyses to understand whether these policies and their impact on human mobility and routine activity will lead in an increase of car theft as a result of lower guardianship and higher staticity, making the car an easier target for potential offenders, as an alternative explanation to our initial hypothesis.

Overall Crimes

Finally, we considered all reported crimes in the period under analysis for the city of Los Angeles. It is worth to note that this aggregated variable also accounts for all those offenses that go beyond the previous considered categories. Table 11 provides quantitative estimates for all these crimes.
|                  | Univariate |                  | With Cov. |
|------------------|------------|------------------|-----------|
|                  | Average    | Cumulative       | Average   | Cumulative |
| Actual           | 558        | 6700             | 558       | 6700       |
| Prediction (S.D.)| 592 (14)   | 7098 (165)       | 590 (13)  | 7086 (152) |
| 95% C.I.         | [567, 620] | [6805, 7441]     | [564, 615] | [6772, 7376] |
| Absolute Effect  | -33 (14)   | -398 (165)       | -32 (13)  | -386 (152) |
| 95% C.I.         | [-62, -8.8]| [-741, -105.1]   | [-56, -6] | [-676, -72] |
| Relative Effect  | -5.6% (2.3%) | -5.6% (2.3%)   | -5.4% (2.1%) | -5.4% (2.1%) |
| 95% C.I.         | [-10%, -1.5%] | [-10%, -1.5%] | [-9.5%, -1%] | [-9.5%, -1%] |
| Posterior tail-area probability p: | 0.00555 | 0.01493 |
| Posterior prob. of a causal effect: | 99.44% | 98.51% |

Table 11: Causal Impact Analysis - Overall Crimes

While the majority of offense categories previously analyzed did not provide any significant effect of the policies in reducing or increasing crime in Los Angeles, when we consider all the reported crimes, the results are in line with those seen for robbery, shoplifting, and theft. In the univariate model, the cumulative absolute and relative effects are respectively -398 and -5.6%, considering a predicted average value of 592 and a cumulative equal to 7098. The effects are only slightly lower for the multivariate case. The cumulative absolute and relative effects are respectively -386 and -5.4%, with a predicted average value of 590 and a predicted cumulative value of 7086. In the former case, the posterior probability of a causal effect is equal to 99.44%, while in the former the probability is 98.51%. The results are in line with the figures described in a recent online article which showed a strong decrease in the first fifteen days of March 2020 compared to the ones made one year ago, in March 2019 (Poston, 2020). These findings suggest that, potentially, most crimes are experiencing sensible effects leading to a general reduction of crime in the entire city of Los Angeles, showing how, besides the chosen categories for this work, further work is needed to disentangle mechanisms related to single offenses or categories.

4 Discussion & Conclusion

The first three months of 2020 have experienced the global outbreak of a new virus belonging to the coronavirus family, named 2019-nCoV, which rapidly spread all over
the world. This forced the WHO to first declare the virus a global health emergency at the end of January—due to the several thousand cases reported in China, the first country to be hit by 2019-nCoV—and then, after the diffusion to the large majority of the world, to announce the global pandemic on March 11th. The United States registered the first confirmed case in the State of Washington on January 21st. Soon thereafter, new cases were reported. One of the first States to be affected by the spread of the virus was California. As a result of the increasing number of cases, the county of Los Angeles - representing the second-most populated metropolitan area in the United States - declared the state of emergency. While the first issued policies to help the containment of the virus were soft recommendations on social distancing, institutional intervention started to become stronger on March 16th, with the prohibition of all events comprising fifty or more attendees. On March 19th, however, the California Department of Public Health further reinforced the containment strategy, ordering all individuals living in the State to stay at home or their place of residence (County of Los Angeles, 2020).

As happened in other countries (e.g., South Korea and Italy), these measures strongly impact on the daily habits of each living in areas of the United States in which such directives and policies have been promulgated. Micro-level human dynamics, mobility patterns, urban concentration, and public life are among the main social dimensions that will be disrupted and significantly modified. Among these dimensions, crime stands as well. As self-isolation, quarantine, and avoidance of social contact result in a lower density of interactions and in the increase of time spent at home, several criminological theories suggest that this could lead to a change in temporal criminal trends. This work specifically tested the impact of the Los Angeles State of Emergency and subsequent measures on eight crime categories and the overall number of crimes reported in the city. Developing hypotheses inspired by the criminological literature on routine activity theory (Cohen and Felson, 1979) and pattern theories of crime (Brantingham and Brantingham, 1981), we applied Bayesian Structural Time Series to evaluate the causal effect of the 2019-nCoV containment policies, exploiting daily data gathered from the Los Angeles Open Data Portal covering the period January 1st 2017-March 16th 2020.

Although preliminary, the statistical results already show interesting patterns. Among the selected crime categories, and in line with our hypotheses, robberies, thefts, and
shoplifting already show a statistically significant reduction in the post-intervention period. Robbery has the largest decrease (-23%/-24%), followed by shoplifting (-14%/-15%) and thefts (-9.1%/-9.6%). Furthermore, overall crimes are also in decline (-5.4%/-5.6%), as partially showed also by Poston (2020). Contrarily, assaults with a deadly weapon, battery, burglaries, intimate partner assaults, and stolen vehicles do not report any significant effect in the first two weeks after March 4th.

It is important to highlight that these results are rather partial, as they take into account time points up to March 16th, and they thus capture short-term dynamics of a time-frame in which only mild policies were applied to the city of Los Angeles. Their soft nature, however, has to be integrated with the fear of contagion that may have played a role in reshaping and reducing people’s social interactions even before the stricter interventions of the second half of the month. In addition, social distance restrictions may have also influenced the reporting rate of criminal offences affecting somehow the results. People are avoiding to spend time outside their home and this might have reduced their willingness or ability to go to the police to report a crime. In the case of Los Angeles, however, problems related to a reduction of crime reporting are mitigated by the possibility to report a crime using an online form for specific crimes (e.g., theft or theft from vehicles) or calling a dedicated number. This might help to reach solid estimates in the near future making use of additional data.

In the following updates, we expect that new or stronger dynamics will emerge. Besides crime evolution as a product of the reduction of opportunities and the evolution of social life, mental stress and fear of crime will also likely have a role in these dynamics. Given the strong scientific evidence on the negative psychological outcomes of quarantine (Brooks et al., 2020), and the recent news showing a dramatic increase in the purchase of firearms in the United States (Oppel, 2020; Lee and Chabria, 2020), it is not unreasonable to expect anomalous peaks of violent crimes in the following weeks. Nonetheless, analyses on the medium term should be conducted more carefully given that, as time passes (say, in the order of weeks or months), other factors will potentially become part of the explanation on the variation of crime trends. Depending on the social and economic policies that will be adopted, among these are, for instance, impoverishment and unemployment. The change of the socioeconomic context may reverberate on crime and on crime motivation thus calling for the integration of situational
theories of crime with structural theories.

Additional caution should be made in interpreting the results obtained. As the extant criminological literature clearly demonstrates, crime is clustered in time and space, meaning that its geographical and temporal distribution is not random (Doran and Lees, 2005; Grubesic and Mack, 2008; Mohler et al., 2011; Weisburd, 2015; Haberman et al., 2017). There are thus very few reasons to think that this patterned nature will change despite the containment measures that have been (or will be) issued. Our hypothesis, which future work should systematically test, is that changes in criminal trends are not uniform across different neighborhoods due to the different economic destination of the neighborhoods and because of their different social fabrics. Crime displacement is also likely to occur (Cornish and Clarke, 1987; Guerette and Bowers, 2009), at least in response to the change in police’ routines and activities.

A further consideration involves potential alternative dynamics that cannot be shown by the set of crime categories chosen for this work. In fact, while research suggests that offenders, just like any other individual, will routinely visit the same areas (e.g., activity space) and are less likely to venture into unknown areas of equal opportunities (Birkbeck and LaFree, 1993), there could be several other types of crime exhibiting completely different dynamics. In this broad set of offenses we hypothesize cyber-related and -mediated crimes, frauds, human smuggling and trafficking, and organized crime-related crimes. Alternative forms of criminal displacement, as tactical- or perpetrator-displacement (Guerette and Bowers, 2009) could also occur as a result of new opportunities arising in the aftermath of a situation of emergency and high uncertainty. Also with respect to these crimes, it has to be observed that short-, medium-, and long-term effects might be significantly different due to emerging needs by the population—e.g., the need for funds to save endangered businesses—and criminal adaptation capabilities—e.g., reorganization of drug dealing.

This first version of the work has underlined how 2019-nCoV-containment policies have already influenced criminal trends in the city of Los Angeles. This study has policy implications that should be kept in mind. First, studying criminal dynamics in this extraordinarily anomalous time for humankind should help to assess who are the most vulnerable subjects influenced by these changes, including homeless, women and children. Homeless, for instance, could experience an increase in the likelihood of becoming
victims of crimes, as a consequence of lower guardianship and social control. Furthermore, as people are forced to spend more time at home, the probability of intimate partner violence could become extremely high. Research found that intimate partner violence is as prevalent in lesbian, gay, bisexual, and transgender (LGBT) relationships as it is in heterosexual ones, although modalities of intimate partner violence may differ (Ford et al., 2013). For this reason, and to protect all the citizens involved in this health crisis, a systematic analysis of crime should also serve to the purpose of empowering remote contact points, facilitating distance reporting to make it easier for victims of domestic violence and abuse to connect with the law enforcement agencies. Second, evidences showing an overall reduction of crimes should motivate the launch of campaigns aiming to dissuade citizens from arming themselves, as they do not face an increased likelihood of being victimized. Finally, as crime takes new forms and patterns, law enforcement agencies will be called to modify or re-evaluate predictive models built on millions of past observations that, however, may not be informative anymore. This situation thus urges for alternative predictive tools that can take into account major disruptions of social life as the triggers of new criminal risks and redefinition of resource allocation as a reflection of new priorities.
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