Crime in the era of COVID-19: Evidence from England

Kyriakos C. Neanidis and Maria Paola Rana

February 2021

Economics

Crime in the era of COVID-19: Evidence from England

Kyriakos C. Neanidis[a,*] and Maria Paola Rana[b]

[a] Department of Economics, University of Manchester, United Kingdom

[b] Salford Business School, University of Salford, United Kingdom

First complete draft: 12 February 2021

This version: 12 February 2021

Abstract

The rapid spread of the COVID-19 pandemic and the prescribed countermeasures of restrictions to mobility and social distancing are disrupting economic activity around the world. This applies to legal economic activity but also to criminal behavior and illegal activity. In this study, we investigate the effects of COVID-19-induced lockdowns on recorded crime in England. The enforcement of lockdowns in the country at both the national and local levels, temporally and spatially, allows unveiling the impact on criminal activities by type of shutdown policy. We use official crime data across the universe of local authorities dating back to May 2013 for all recorded crime categories. We find that (1) National lockdowns decrease all types of criminal behavior, except for anti-social behavior, drug offences and crimes against public order which are recording increases. (2) Relaxing national lockdown restrictions attenuates the initial crime effects of strict lockdowns across all crimes. (3) Local lockdowns affect fewer crime categories, limited to increasing anti-social behavior and weapons possession offences and decreasing bicycle theft and other theft violations, with findings being driven by late-entry areas of such policies. (4) A change in the local lockdown scheme implemented by the government in October 2020 does not have a markedly dissimilar effect on criminal activity compared to the earlier scheme. (5) Back-of-the-envelope calculations suggest that government-mandated lockdowns reduced the economic costs of crime by approximately £4.3 billion for the country as a whole (in 2020 British pounds).

JEL Classification: I18; K14; K42

Keywords: Coronavirus; COVID-19; Crime; Lockdown; Police

---

[*] Corresponding author.

  E-mail addresses: kyriakos.neanidis@manchester.ac.uk (Kyriakos C. Neanidis), M.P.Rana@salford.ac.uk (Maria Paola Rana).

1. Introduction

National and local governments around the world attempted to mitigate the spread of COVID-19 using lockdown policies that limit mobility and social interactions. The UK Government represents no exception since from March 2020 it has implemented a series of measures in England, including national lockdowns for prolonged periods which when lifted were replaced by more locally-focused lockdowns in regions with a high epidemiological load of the virus. These policies have taken their toll on economic production, consumer spending, and the labor market (for the US see Allcott et al., 2020; Binder, 2020; Chetty et al., 2020; Crucini and O'Flaherty, 2020; Kong and Prinz, 2020). But, they have also affected the illegal market.

In this paper, we examine the impact of the pandemic-induced lockdowns in England on criminal activity manifested by recorded crime counts. Lockdowns have changed the opportunities for crime by changing the expected benefits and costs of committing a crime. In particular, lockdowns have simultaneously decreased the benefits from crime and increased the costs since with more people out of the streets and into their houses, there are fewer opportunities for engaging in a criminal activity at a higher risk of apprehension by the police. In line with Becker (1968)'s rational model of criminal behavior, this means that lockdowns reduce the incidence of crimes against the individual, such as robbery and theft from the person. This, however, may not be the case for the so-called crimes against society, that include anti-social behavior and public order offences, which might increase as people refuse to comply with lockdown measures. Similarly, drug offences may increase since the police represent the main source of detection for this crime, and the increased police presence due to a lockdown may identify more easily such perpetrators. This rationale coincides with several high-profile news outlets in England, which since the start of the pandemic have reported noticeable changes in recorded crimes by the police.[1] However, reported crime incidents typically exhibit seasonal patterns, suggesting some of the recent recorded crimes might be due to seasonal trends.

England is a unique setting for this study because by December 2020 the national government imposed two national lockdowns followed by two periods of re-opening. During the latter, the government enforced two different schemes of local lockdown measures, until 13

---

[1] See, for example, https://www.bbc.co.uk/news/uk-53919786, https://news.sky.com/story/significant-drop-in-crime-during-coronavirus-lockdown-but-drug-offences-rise-12056922, https://www.theguardian.com/uk-news/2020/apr/15/in-uk-falls-sharply-since-start-of-coronavirus-lockdown, https://news.sky.com/story/drug-crimes-rose-by-a-third-during-lockdown-in-england-and-wales-12116785.

October 2020 the first and thereafter the second, that allows testing the effect on crime along various dimensions: (i) in areas that have been strictly locked down against those that did not or did so mildly, (ii) based on the type of local lockdown scheme, and (iii) depending on the timing of treatment, of early- versus late- locally locked down areas. To assess the impact of lockdown policies on crime, we use difference-in-difference and event study methods to compare recorded crime numbers across the universe of lower-tier local authorities in England during and after the national lockdowns were put in place, relative to pre-lockdown trends over several years. We also examine the impact of local lockdown policies, applied specifically to local authorities that exhibited a high incidence and spread of the disease, by using a combination of temporal and spatial variation in the government-mandated application of lockdowns.

The data we use are reported by the Police UK, the body in charge of policing in the country. Crime is classified into fourteen categories, and we use all of them in the analysis by also creating an all-encompassing category of total crime by adding crime across all groups. Crime counts are available at the monthly level, from May 2013 to December 2020, for each of the lower-tier local authorities in England. As such, we use local authority-month level data on crimes to estimate the impact of lockdowns. To our knowledge, ours is the first study to examine the criminal impact of lockdowns in England in a comprehensive way, by considering both sets of the national shutdown and re-opening phases, and the differential effects local lockdowns may have on criminal behavior, for a period stretching for over nine months.

We find that although total crime has only decreased by 2.3 percentage points during the entire lockdown period from March to December 2020, there have been substantial shifts in the distribution of crime counts across crime categories. Recorded crimes fell significantly in the majority of categories, with the largest drop of 59 percentage points registered in theft from the person. There were also substantial declines in robberies, shoplifting, motor vehicle theft, other theft, burglaries, criminal damage and arson, violence and sexual offences, and weapons possession. As expected, there were increases in drug offences and crimes against society with most prominent a rise in violations for anti-social behavior by 38 percentage points. Two crime categories, bicycle theft and other crime, have not displayed any significant changes. When treating separately the periods of national lockdowns from their retraction, results indicate that both periods caused changes in crime but the effects became weaker during the post-lockdown stage. This treatment reveals that during national lockdowns even bicycle theft and other crimes

recorded a decline, with no changes occurring after the lockdown lapsed. This finding is consistent with the idea that a partial or full re-opening of the economy after a lockdown is accompanied with a transition in crime numbers towards their pre-lockdown equilibrium. The sole exception here is crimes against public order which from a decline during the national lockdown they recorded an upsurge in the post-lockdown period.

In addition to the effects of national lockdowns, our analysis reveals the impact of local lockdown arrangements. Our findings show that the effects of local lockdowns on crime are less potent than those of national lockdowns, and restricted to a few crime categories. We find evidence of an increase in anti-social behavior (by 16%) and possession of weapons (by 25%), and of a decrease in other theft (by 8%) in local authorities that saw strict lockdown measures relative to authorities that had no or mild measures in place. We also find that half of the total number of crime categories responded more in local authorities that entered a lockdown at a late stage when compared to authorities that did not enter a local lockdown, relative to the pre-local lockdown period. According to this, a late entry increased the number of anti-social behavior offences and reduced crime violations in burglaries, vehicle theft, other theft, bicycle theft, crime against public order, and possession of weapons. This suggests a largely beneficial effect for local authorities placed under a lockdown at a later stage. Further, we show that the change in the structure of the local lockdown scheme post-13 October 2020 has had no differential impact on recorded crime compared to the first local lockdown scheme. We view this as evidence that both lockdown systems affected crime in largely similar ways.

Together, these results provide support to the argument that lockdowns in England played an important role in changing the shape of criminal activity. The economic magnitude of this shift is non-trivial. Using our baseline estimates, it suggests that the lockdowns during the year 2020 generated crime benefits to society: approximately £4.3 billion in gains from crimes that would otherwise have taken place (in 2020 British pounds).

Our contribution sits within the growing literature that explores the onset of the pandemic on criminal behavior. The literature can be largely divided into two groups, a rich set of studies addressing the effect of the pandemic on domestic violence and a smaller group exploring the impact on a wider set of criminal activities. Research on domestic violence against women and children has been conducted for several cities and countries (Aguero, 2021 for Peru; Arenas-Arroyo et al., 2021 for Spain; Bullinger et al., 2020 for Chicago; Leslie and Wilson, 2020 for 14

US cities, Miller at al., 2020 for Los Angeles; Perez-Vincent et al., 2020 for Argentina; Ravindran and Shah, 2020 for India; Silverio-Merillo et al., 2020 for Mexico City) but has offered mixed and inconclusive findings with some studies finding an increase, and others suggesting a decrease or no change of domestic violence during the pandemic. The lack of consensus is attributed to the persistent under-reporting characterizing incidences of domestic violence, which were exacerbated by the stay-at-home conditions enforced by the lockdown as the latter increased the cost to victims of reporting abuse to authorities.

Our empirical contribution is most closely related to the fewer studies that take a more general approach and estimate the effect of the pandemic on a larger array of crime categories. These include analyses for Los Angeles (Cambedelli et al, 2020a), Chicago (Cambedelli et al, 2020b), and Bihar, India (Poblete-Cazenave, 2020). But, the closest to our work is Abrams (2021) and Kirchmaier and Villa-Llera (2020). Abrams (2021) uses data from 25 US cities to examine the response of fourteen individual crime categories during the initial stage of the pandemic that includes up to seven weeks after the implementation of a stay-at-home order in a city. Our work, using an equally high number of crime categories, provides an analysis for all geographic areas in a country which also have crime data available throughout the examined period.[2] Our analysis also covers a longer period that in addition to the initial stage of the pandemic includes the entire year of 2020, while we also present results for national lockdown periods. Kirchmaier and Villa-Llera (2020) is the only other study that considers the entire jurisdiction of England (also adding Wales). The authors use the entire universe of crime categories in the country, similar to us, to examine the correlation between changes in unemployment benefits and criminal activity during the first national lockdown and post-lockdown periods, i.e., until September 2020. Our focus is different to theirs, as we take an agnostic view about the precise mechanisms at play driving the changes in crime patterns. At the same time, our analysis extends upon their period coverage until the end of 2020 and also accounts for the effects of lockdowns at the local level, thus allowing for a more comprehensive treatment of changes in crime since the start of the COVID-19 epidemic.

---

[2] Instead, the number of cities in Abrams (2021) with available crime data varies depending on the category of crime under consideration. For example, the maximum number of cities for any given crime is nineteen, while for the crime of rape the number reduces to just four cities. Further the use of a single national source of recording crime data, Police UK in our case, means there is a consistent way of recording data across all territorial police forces by following the same definitions and rules, compared to US state or city police forces where procedures may somewhat differ.

The rest of the paper proceeds as follows. Section 2 presents a timeline of the spread of COVID-19 in England and of the subsequent policy responses at national and local levels. Section 3 describes the data for the analysis. Section 4 formalizes the empirical strategy based on difference-in-difference and event study specifications. Section 5 presents the estimation results and robustness checks. Section 6 uses the estimates to quantify for England the economic costs and benefits associated with the changes in recorded crime numbers. Last, Section 7 concludes.

2. Context and Timeline

On 30 January 2020, England recorded its first two cases of the novel coronavirus disease 2019 (COVID-19) in York. By 11 March, the day the World Health Organization declared COVID-19 a global pandemic, the cumulative number of confirmed cases in England rose to 1,136 individuals. Five days later, on 16 March, the UK Government advised citizens to cease all non-essential travel and contact with others, to work from home if possible and to stay away from pubs, clubs and theatres. This was followed by an announcement that on 20 March schools and public venues were required to close, the same day the Chancellor announced the Coronavirus Job Retention Scheme to protect people's jobs and incomes.

As infection rates continued to grow, on 23 March the government introduced a national lockdown. Lockdown rules required people to stay home at all time except for essential activities, restricted to shopping for necessities, work travel if remote work was not possible, medical needs, and one form of exercise a day (Cabinet Office, 2020). The national lockdown was in place for over two months, and was lifted on 31 May. Figure 1 illustrates the timeline of the national lockdown, which for our purposes is considered to begin on 16 March when mobility controls were first introduced to the public. The figure also shows the dates for the first post-national lockdown period (1 June-4 November), the second national lockdown dates (5 November-1 December), and the second post-national lockdown period (2 December 2020-5 January 2021). From 6 January 2021, England has been placed on a third national lockdown, still in effect at the time of writing.

In addition to national lockdown dates, Figure 1 presents the in-between periods during which the UK Government enforced lockdown regulations at the local level in an effort to control the incidence and spread of the disease in a more targeted approach. On 4 July, Leicester was the first area to be subject to local restrictions (Public Health England, 2020 No. 685), with

many other local authorities added until 13 October.[3] On 14 October, the government abandoned its attempts to control the spread of COVID-19 by means of piecemeal local regulations and introduced a 3-tier approach across England, with legal restrictions varying according to government-defined tiers. Tier 1 areas were referred to as "medium" restriction areas, Tier 2 "high" restriction areas, and Tier 3 "very high" restriction areas. In Tier 1 areas a minimum set of restrictions were put in place, while in Tier 2 areas the higher level of infections enforced some additional restrictions. Tier 3 areas faced the tightest restrictions since they registered the highest levels of infections in the country.[4] On 14 October, out of the 317 local authorities, 269 were classified as Tier 1, 42 as Tier 2, and 6 as Tier 3. During the 14 October-4 November period, the government has been shifting local areas across tiers depending on the development and propagation of the disease within their geographic boundaries. For example, on 17 October, the first time areas were being shifted, fifty-one new local authorities moved from Tier 1 to Tier 2, while fourteen further authorities moved from Tier 1 to Tier 3. On this date, Tier 1 numbered 204 areas, Tier 2 had 93 areas, and Tier 3 had 20 areas. Figure 2 shows a snapshot of the spatial distribution of the local areas into the three tiers on 31 October.

On 5 November, the tier regulations have been revoked and were replaced by the second national lockdown, which lasted until 1 December. From 2 December, after the end of the second national lockdown, the government continued to implement the 3-tier system of local lockdown rules. This was modified on 20 December by adding a further tier, Tier 4, the restrictions of which were equivalent to those of the second national lockdown. Figure 3 shows the spatiotemporal distribution of the local areas' classification for different lockdown phases during 2 December 2020-5 January 2021, the most recent period during which local lockdown restrictions were in effect.

3. Data

England is divided into nine geographic regions, further subdivided into 317 lower tier local authorities (comprised by London Boroughs, Unitary Authorities, Metropolitan Districts, and Non-Metropolitan Districts). Every local authority belongs to one of the thirty-nine territorial police forces, which are recording and reporting data on criminal activities. The data

---

[3] Specifically, out of the 317 lower tier local authorities in England, the number of areas under local restrictions was 6 in July, 17 in August, and 48 in September and October, by 13 October.
[4] Details of restrictions for each tier can be found at Department of Health and Social Care, 2020.

are at the local authority-month level by category of crime and are publicly available from Police UK.[5] The source offers data from December 2010, although since it has changed twice the taxonomy of crime categories with the current classification being in effect since May 2013.[6] For consistency purposes, therefore, our panel begins in May 2013 and extends to December 2020.[7] The closing month of the sample allows the inclusion of two periods of national lockdown and two periods of post-national lockdown, the latter having in place local lockdown arrangements across local authorities (see Figure 1).

The types of crime are classified into fourteen different categories. These are: anti-social behavior, bicycle theft, burglary, criminal damage and arson, drugs, possession of weapons, crime against public order, robbery, shoplifting, theft from the person, motor vehicle crime, violence and sexual offences, other theft (such as blackmail, theft by an employee, theft from automatic machine or meter, making off without payment), and other crime (including racist and religious hate crime, homophobic crime, robbery of mobile phone). We denote total crime the sum of all fourteen crime types, although in some cases we also report total crime excluding anti-social behavior. The presence of many crime categories allows conducting the analysis at the local authority-month-crime type level.

To the best of our knowledge, this data are the most granular data possible for criminal reporting at the local level across England. The primary advantage of the data is the long time series, allowing for a comprehensive analysis of the periods before and after the onset of the lockdown, i.e., pre- and post-March 2020. At the same time, there exists a limitation in that the lockdown periods, be it national or local, in most instances do not start at the beginning of a calendar month nor do they last for full months, which is the time frame crime data are being reported. For instance, the first national lockdown enacted on 16 March includes sixteen days for this month and all days for the months of April and May, given it was revoked on 1 June. Similarly, the second national lockdown between 5 November and 1 December contains twenty-six days for November and one day for December.

---

[5] Data can be accessed at https://data.police.uk/data/archive/.

[6] From December 2010 to August 2011 there are six categories of recorded crimes, rising to eleven between September 2011 and April 2013, thereafter increasing to fourteen.

[7] Out of the thirty-nine police forces, Greater Manchester Police, which has ten local authorities, has not submitted crime data to Police UK since July 2019. For this reason, Greater Manchester local authorities are excluded altogether from the analysis. In addition, Humberside Police, with four local authorities, has not reported data for December 2020, and the Devon and Cornwall Police has not declared crime data for the authority of the Isles of Scilly for November and December 2020. All other data are available and included in the analysis.

To overcome this drawback, we follow Poblete-Cazenave (2020) in constructing the dummy variables for the various lockdown periods in such a way that they represent the proportion of the month where the condition associated with the variable is satisfied. To fix ideas, denote $National_{M,2020}$ a dummy variable for the periods of 16 March-31 May and 5 November-1 December 2020, i.e., the periods during which England was under a national lockdown. Then, if the condition associated to this variable is 'switched on' at day D_1 of month M_1, then $National_{M1,2020} = \frac{\#M_1 - D_1 + 1}{\#M_1}$, where $\#M_1$ denotes the number of days in month M_1. Further, if the condition is 'switched off' at day D_2 of month M_2, then $National_{M2,2020} = \frac{D_2}{\#M_2}$. This means that $National_{M,2020}$ is equal to $\frac{31-16+1}{31}$ in March 2020, 1 in April and May, 0 in June to October, $\frac{30-5+}{30}$ in November, and $\frac{1}{31}$ in December 2020. Following this principle, if $Post_{M,2020}$ indicates a dummy variable for the periods after the end of a national lockdown, i.e., during 1 June-4 Nov and 2-31 December 2020, it takes the value of 1 in June to October, the value of $\frac{4}{30}$ in November, and the value of $\frac{31-2+1}{31}$ in December 2020. The dummy variables for local lockdown periods are constructed by following the same approach, where now the values can also change across local authorities (this variable we denote below $Local_{M,2020}$).

Figure 4 plots the monthly number of crimes between May 2013 and December 2020. It includes the counts for total crime, total crime less antisocial behavior (ASB), and each of the fourteen categories of crime. To visualize the response of crime during the outbreak of COVID-19, the vertical red dashed line denotes March 2020 when the first national lockdown was introduced in England. We observe jumps in the number of reported crimes starting in March 2020, followed by partial or full rebounding as time progresses. This is particularly visible in the top right panel where all four crime categories (burglary, criminal damage and arson, motor vehicle theft, and other theft) record a sizeable decrease that subsequently partly recovers. At the opposite side, we also see types of crime that record immediate increases in response to the lockdown before they subside, such as antisocial behavior, crimes against public order, and drugs.

To consider magnitudes of change, Table 1 shows mean values and standard deviations for criminal activity for the pre-lockdown period (May 2013 to February 2020) and separately for the lockdown (16 March to 31 May, 5 November to 1 December) and post-lockdown periods

(1 June to 4 November, 2 to 31 December). It further shows the percentage point difference between the treatment and control periods, i.e. between lockdown and pre-lockdown, and between post-lockdown and pre-lockdown. All crime types change during national lockdowns, with the most potent increase recorded in crimes against public order (by 43 percentage points) and the strongest decrease in theft from the person (by 57 percentage points). During post-lockdown periods, recorded crime counts also vary with the largest changes compared to pre-lockdown observed once again in theft from the person (down by 40 percentage points) and crimes against public order (up by 60 percentage points).

Figure 1 indicated that during the two post-national lockdown periods, restrictions were not uniformly lifted across local authorities but were enforced on localities that exhibited a high incidence of virus transmission. This difference in local restrictions may have affected the response of criminal behavior during these periods in local authorities that endured lockdowns against those that did not. Figure 5 plots the crime response of the two groups. The blue line represents the average over local authorities which experienced a local lockdown, and the green line depicts those that did not. The data coverage starts in March 2019 to include a sufficiently long period before the practice of local lockdown restrictions began in July 2020, the latter indicated by the vertical orange dashed line. We also include the March 2020 national lockdown date as reference, once again denoted by the red vertical line.

A few key patterns emerge from Figure 5. Before July 2020, both types of local authorities had similar trends in the number of recorded crimes. This also applies from March to June 2020 when the first national lockdown was in place. Since July 2020, however, a clear demarcation has taken place with localities under a lockdown exhibiting higher numbers of recorded crime, across all types of crime except bicycle theft. This is corroborated by the difference-in-mean statistics between the two groups of local authorities presented in Table 2, which decomposes those that experienced a local lockdown between the first lockdown arrangements in 4 July-13 October and the Tier 2-4 system during 14 October to 31 December. Each of these groups is compared against authorities that did not undergo a strict local lockdown. Columns (4)-(5) show that local lockdowns induced a large increase in the number of reported crimes, regardless the type and severity of local lockdown arrangements. Across these columns, the increases range between 11 and 75 percentage points, both recorded for crimes against public order. The only exception is bicycle theft which recorded a small decrease of 3-6 percentage

points in areas and periods experiencing a strict local lockdown. We explore these patterns in depth next.

4. Empirical Approach: Difference-in-Difference and Event Study Models

The simple analysis above provides suggestive evidence that the implemented national and local lockdowns due to COVID-19 may have contributed to changes in the incidence of crime and in the distribution of crime across its various categories. However, it fails to account for the variation in treatment timing (see Figures 1-3), seasonal changes in crime (see Figures 4-5), and differences in characteristics of local authorities. To account for these complications, we rely on both difference-in-differences and event study methods. Below we present the models, separately for periods of national and local lockdowns.

4.1 National Lockdowns

To estimate the causal effect of the pandemic on crime counts, we begin by using a difference-in-differences design to compare monthly crime levels within a given local authority before and after the onset of a national lockdown. Figure 1 shows the timeline of the pandemic and defines the time periods in our analysis. We define before 16 March 2020 as the control period and from 16 March 2020 onward the treatment period. In this way, we estimate differences in the treatment and control months prior to and after the 16 March 2020 national lockdown announcement. By including all available month-years since May 2013 in the analysis we can look at changes relative to the mean with more information across time.

To quantify average effects, we estimate the following equation:

$$C_{amy} = \alpha + \alpha_a + \alpha_m + \alpha_y + \alpha_{am} + \alpha_{ay} + \beta Lockdown_{M,2020} + \varepsilon_{amy}, \tag{1}$$

where C_{amy} is total crime or a crime category in local authority a in month m of year y. Local authority fixed effects, α_a, control for both observable and unobservable differences across local authorities that do not change over time, including attitudes toward criminal activities. Month fixed effects, α_m, control for variables that affect all local authorities in a given period such as the monthly seasonality of crime counts seen in Figure 4, or national news about the coronavirus. Year fixed effect, α_y, control for country-wide annual trends in recorded crimes over time. Local

authority-by-month fixed effects, α_{am}, and local authority-by-year fixed effects, α_{ay}, are added to flexibly control for time-invariant drivers of crime specific to a local authority across months or years, such as the presence of a local criminal organization and possible differences in seasonality of crime across authorities. Finally, $Lockdown_{M,2020}$ is a dummy variable for the 16 March-31 December 2020 treatment period equal to zero before March 2020, $\frac{31-16}{31}$ in March 2020, and 1 thereafter. All standard errors are clustered by local authority.

The goal of the analysis is to identify the causal effect of the COVID-19-induced lockdown on crime count, represented by the coefficient β. This coefficient of interest represents the average difference in crime counts between the control and treated groups after lockdown treatment begins in March 2020 relative to the monthly average from May 2013-February 2020 (the control months). The identification of β requires that, conditional on the fixed effects included in the regression, the error term in equation (1) is uncorrelated with $Lockdown_{M,2020}$. This can be interpreted as the standard parallel trends assumption, i.e., absent the lockdowns, recorded crime after 16 March 2020 would have continued on the same trend as it did in previous month-years. This assumption will be violated if England in the absence of the pandemic would have experience specific crime shocks that are different to those in the previous years. In other words, the application follows the standard difference-in-difference model with one treatment group, one control group, and a single time period where treatment status changes in the treatment group. In such models, the coefficient β identifies the average treatment effect for the treated group.

A second goal of the analysis is to measure the extent to which the effects of a national lockdown on crime differ from the effects of a post-national lockdown period. Figure 1 illustrated how the period since 16 March 2020 is divided into two lockdown and post-lockdown periods respectively, while Table 1 reported crime counts for both these periods (and how they compare to the pre-lockdown period). Due to the lifting of national restrictions in the post-lockdown period, the (full or partial) reinstatement of people's mobility may affect the incidence of crime differently compared to when a lockdown is in effect. Taking thefts for instance, having relatively more people on the streets after the end of a strict lockdown raises the number of potential victims and therefore a criminal-victim match, thus increasing the expected number of thefts compared to the lockdown period. Put differently, relaxing mobility restrictions post-lockdown is expected to decrease thefts by less relative to pre-lockdown compared to when strict

restrictions are applied. To allow for this likelihood, we replace the variable $Lockdown_{M,2020}$ in equation (1) with its two counterparts $National_{M,2020}$ and $Post_{M,2020}$, as these were defined in the previous section. Effectively, we estimate the following equation:

$$C_{amy} = \alpha + \alpha_a + \alpha_m + \alpha_y + \alpha_{am} + \alpha_{ay} + \beta_1 National_{M,2020} + \beta_2 Post_{M,2020} + \varepsilon_{amy}. \qquad (2)$$

The specification includes the same set of rich fixed effects as in equation (1). The coefficient β_1 is an estimate of the average change in recorded crime between the national lockdowns in 2020 and the average seasonal variation during the control months of the sample (May 2013-February 2020). In the same fashion, the coefficient β_2 is the estimate for the change in crime levels in the post-lockdown periods relative to the pre-lockdown period.

In addition to the above difference-in-difference models, we estimate a monthly event study model to check for parallel trends during the pre-lockdown period and to consider how effects evolve across individual months, during the national lockdown and post-lockdown periods. The event study model is

$$C_{amy} = \alpha + \alpha_a + \alpha_m + \alpha_y + \alpha_{am} + \alpha_{ay} + \qquad (3)$$
$$+ \sum_{i=1}^{11} \beta_i \theta_i + \sum_{i=13}^{22} \gamma_i \theta_i Lockdown_{M,2020} + \varepsilon_{amy},$$

where the outcome variable, the fixed effects, and the variable $Lockdown_{M,2020}$ are defined as in equation (1). θ_i refer to month dummies corresponding to the months March 2019 ($i = 1$) to December 2020 ($i = 22$). γ_i are the coefficients of interest. They trace out monthly changes in the number of crimes during the months March 2019 to December 2020 relative to the previous period since May 2013. The month of February 2020 ($i = 12$) is excluded from the controls because it represents the reference month: the month before the national lockdown order is enacted for treated months. Therefore, the coefficients γ_i capture the impact of local authorities experiencing a lockdown in month i relative to the monthly average from May 2013-February 2019 when compared to the reference month.

An advantage of the event study model over the difference-in-difference model, besides tracking the dynamic effects of lockdown policies, is that the former allows testing for the assumption of parallel trends prior to the onset of the pandemic. The validity of the identifying

assumption requires that during the pre-lockdown months the number of crimes for the treatment and control groups are not diverging from one another. When presenting findings, we provide support for this assumption.

4.2 Local Lockdowns

The previous section described the methods for establishing the impact of the national and post-national lockdown periods on crime numbers in England, when compared against the pre-lockdown period. But, as Figure 1 established, the post-lockdown periods are characterised by various lockdown schemes at the local authority level. This allows testing separately for the impact of local lockdowns on crime, and how this may differ relative to authorities that did not experience a local lockdown until 13 October or against those with a mild lockdown after 13 October. To estimate the differential effect of local lockdowns during the post-national lockdown periods, we employ an event study model. This empirical strategy uses variation in both *when* and *where* local lockdown policies were introduced, i.e., we exploit temporal and spatial variation across local authorities. Using the quasi-random entry of local authorities into a local lockdown, we exploit the panel structure of the authorities-month-year level data and run the following specification for authority a in month m of year y:

$$C_{amy} = \alpha + \alpha_a + \alpha_{my} + \alpha_{am} + \alpha_{ay} + \sum_{i=1}^{16} \beta_i \theta_i Local_a + \sum_{i=17}^{22} \gamma_i \theta_i Local_{M,2020} + \varepsilon_{amy}. \quad (4)$$

As in previous specifications, we include a host of fixed effects that may predict crime counts. The only difference is that we now replace the individual month and year fixed effects, α_m and α_y, with month-by-year fixed effects, α_{my}. This replacement flexibly controls for national trends in reported crimes to the UK police over time, rendering redundant the inclusion of the national and post-national lockdown dummies as controls. As in equation (3), θ_i refer to month dummies corresponding to the months March 2019 ($i = 1$) to December 2020 ($i = 22$). $Local_a$ and $Local_{M,2020}$ are dummy variables, the first equal to 1 for local authorities experiencing a local lockdown and the second equal to the proportion of the month where a local lockdown is in place for the months July to December 2020 for a given authority. The combination of fixed effects used allows us to identify the effect of the local lockdown on crime by comparing crime counts

when the local lockdown is in place versus when there is no strict lockdown, this within a month-year in a given local authority.

The coefficients of interest, γ_i, capture the impact of authorities that undergo a local lockdown relative to the impact of authorities that do not experience a local lockdown (or a mild lockdown post-13 October), in month i relative to the monthly average from May 2013-February 2019 (the omitted months). We present estimates for event times $i \in [1, 22]$. Event times 17 to 22 estimate the causal effect of a local lockdown on crime, and represent the average treatment effect for the treated. Event times 1 to 16 serve as a falsification test that our results are not driven by pre-existing differences in trends between the treatment and control groups before a local lockdown policy is introduced. All of our estimates use a balanced set of authorities, so that our coefficients do not reflect changes in their number. We continue to cluster standard errors at the local authority level.

We also report estimates from an extended specification that mimics equation (4) but within a difference-in-difference framework. It divides the $Local_{M,2020}$ period into the first piecemeal local lockdown period from 4 July to 13 October 2020, $Local_{July-Oct,M,2020}$, and the subsequent tier system of local lockdowns from 14 October to 31 December 2020, $Local_{Tier\ 2-4,M,2020}$:

$$C_{amy} = \alpha + \alpha_a + \alpha_{my} + \alpha_{am} + \alpha_{ay} + \tag{5}$$
$$+\beta_1 Local_{July-Oct,M,2020} + \beta_2 Local_{Tier\ 2-4,M,2020} + \varepsilon_{amy}.$$

This specification allows us to directly test for differences in the effects of the two structures of local lockdown policies on crime and, therefore, assess their relative effectiveness in terms of the magnitude of the impact they exert on crime.[8] The coefficient β_1 captures the impact on crime of areas that experience a local lockdown during the first scheme of lockdown arrangements relative to the impact of areas that do not experience a local lockdown, against the monthly average from May 2013-June 2020 (the omitted months). Similarly, the coefficient β_2 captures the impact of areas where a local lockdown is enforced during the second system of lockdown

---

[8] We also estimate an event study version of this model, the results of which are available upon request. We opt presenting the difference-in-difference estimates due to ease of comparison between the two types of local lockdown structures.

measures (in areas classified as tiers 2-4) relative to the impact of areas that experience a medium level local lockdown (tier 1 areas), compared to the monthly average from May 2013-June 2020 (the omitted months).

While we can compare the two schemes of local lockdown policies by contrasting both against areas that do not experience (or experience milder) local lockdowns, we cannot study the impact on crime across local areas that differ in the severity of a local lockdown, as done for instance by Ravindran and Shah (2020) with respect to violence against women in India. Such an exercise would require a system of local lockdown classification that is consistent across time so that a comparison across different levels of lockdown restrictions is meaningful. The design of the local lockdown scheme in England does not fulfil this requirement because it switched on 14 October 2020 from a binary system (local lockdown vs. no local lockdown) to a 3-tier system (turned 4-tier system on 20 December 2020). Nevertheless, the comparison we are conducting between the two schemes in equation (5) carries important policy implications about their relative impact on crime.

5. Results

5.1 National Lockdowns

We start by looking at the total effect of lockdown policies on each category of crime and its aggregate measure. Table 3 presents the difference-in-difference estimates of the lockdown based on equation (1). Panels A and B split the sixteen classifications of crime, each presenting eight. Both panels list the different sets of fixed effects included in the regressions, while the last two rows of every panel report the average number of reported crimes before the onset of the lockdown and the estimated percentage change in crime due to the lockdown. Standard errors clustered by local authority are reported in parentheses (as in the rest of the empirical analysis).

The results show that lockdown policies affect all types of criminal behavior, except for bicycle theft and other crime which remain unchanged. For the categories of crime that are statistically significant, the difference-in-difference estimates suggest that eleven types have decreased and three have increased due to the lockdown. This highlights a shift in the distribution of crime activities as stay-at-home-orders are in place away from the majority of offences and toward a small number of crimes that include anti-social behavior, drugs, and crime

against public order. All these estimates are statistically significant at the 1% level, with total crime only being significant at the 5% level. The magnitude of the reduction in crime induced by the lockdown ranges from 7.28 percentage points for weapons possession to almost 60 percentage points for theft from the person, with total crime decreasing by just above 2 percentage points (by 18.44 percentage points when excluding anti-social behavior). At the other end, crimes against public order exhibit an increase of 5.53 percentage points, drugs by 14.5 percentage points, and anti-social behavior by 38 percentage points.

Although on net these findings suggest the overall effect of the lockdown on various types of crime, they may mask important variation between the periods during which a national lockdown was in effect compared to post-lockdown periods when restrictions were eased at the national level. This rationale corresponds to the specification in equation (2) that treats separately the national lockdown and post-lockdown periods, compared to the controlled pre-lockdown period. The extended difference-in-difference estimates are reported in Table 4, showing that lifting lockdown restrictions reduces the absolute magnitude of the coefficient estimates and in some occasions even renders them statistically insignificant. The drop in the size of the effect ranges from 6.64% for other crime to 40% for anti-social behavior. This is supported by a test statistic reported at the last row of each panel comparing the coefficient estimates of the lockdown and post-lockdown indicators. This finding is consistent with the idea that a move away from tight national lockdown restrictions, leads to a crime response that is less potent compared to when full restrictions are in place. In other words, a partial recovery of the economy diminishes the initial crime effects of a strict lockdown. Miller et al. (2020) report a similar finding specific to domestic violence reported incidents in the city of Los Angeles when treating separately the initial shutdown period from the one following the initial re-opening.

Table 4 indicates that splitting the treatment period into its two components, even allows bicycle theft and other crime, the two categories of crime that did not respond to the lockdown in Table 3, to pick up statistical significance during national lockdowns recording a decline by 20 and 6.64 percentage points, respectively. Another type of crime worth mentioning is crime against public order which behaves asymmetrically in the post-March 2020 period, recording a decrease by 11 percentage points during national lockdown matched by an increase of the same magnitude post-lockdown. Such asymmetries further highlight the importance of treating separately the period *during* a national lockdown from the period *after* a national lockdown ends.

Next, in an effort to more flexibly investigate differences in reported crime during and after a national lockdown, we also estimate an event study variant of equations (1) and (2), described by equation (3). Figure 6 presents the results with dashed lines depicting 95% confidence intervals. There are sixteen plots, one for each type of crime, including one for total crime and one for total crime that excludes anti-social behavior. The first thing to note is that the event study results are in line with the previously discussed difference-in-difference regression results, the latter visualized by the red horizontal line in each plot. At the same time, Figure 6 offers some interesting qualifications that were not visible in Table 3.

First, with a few exceptions (drugs, other theft, and bicycle theft), estimated effects for the eleven months from March 2019 to January 2020 are relatively small, indicating flat pre-trends for most types of crime. Second, immediately following the implementation of the March lockdown there is a clear break from the pattern of earlier months, indicating a downward jump in the number of all criminal offences bar antisocial behavior which jumps up. Third, although post-March the effects vary over time, for half of the crime categories the number of recorded offences hovers around its new level after the initial jump with no indication of reverting back to its pre-March level. This includes anti-social behavior, burglary, vehicle theft, other theft, shoplifting, robbery, person theft, and total crime excluding antisocial-behavior. For these categories, effects are statistically significant for the entire post-treatment period. A single factor driving the pattern for most these crimes' point estimates is that they represent types of crime where the offender derives material gain from the crime (i.e., acquisitive crime). The restricted mobility of people on the streets, the highly uninterrupted presence in their houses, and the closure of businesses, makes these types of crime very unlikely to be committed. As for anti-social behavior, its higher count number is a direct consequence of people's refusal to abide by lockdown regulations. For the other eight crime types, there is partial or full recovery of recorded offences to their pre-March level.

Taken together, the difference-in-difference and event study results provide support to the notion that criminal behavior has changed since March 2020 as this is evidenced by the number of recorded criminal offences at the national level in England. There was a dramatic shift in the distribution of illegal activity from types of crime that could not be committed (i.e., acquisitive crime) toward those that could be easily identified by the police (i.e., anti-social behavior, public order, and drugs). The severity of the pandemic, manifested by the introduction and easing of

national lockdown restrictions, has been reflected in the changing magnitude of performed crimes which was less intense in times when measures were eased.

5.2 Local Lockdowns

The above analysis illustrates the effects lockdowns have on recorded crimes when implemented, and subsequently relaxed, at the national level. An important advantage of examining England is that when national lockdowns were rescinded, the national government introduced lockdowns at the local authority level. The spatial and temporal variation in lockdown measures across authorities allows us to examine separately the impact of local lockdowns on crime, a matter we turn to in this section. We resort to the event study model described in equation (4), which compares authorities that underwent a local lockdown to those that did not (or did so mildly). The results are shown in Figure 7, where dashed lines represent 95% confidence intervals using standard errors clustered at the local authority level. Every plot also reports the estimate we obtained by using a difference-in-difference variant of the event study model.

We see that the coefficient point estimates for the months before the local lockdown was imposed are close to zero across all crime categories, suggesting little evidence of pre-trend differences in this setting. We also see that after local lockdown measures were initiated in July 2020, spikes are recorded in the reporting of most criminal offences. However, these are mostly statistically insignificant. Notably, we observe large and statistically significant increases in the number of anti-social behavior and possession of weapons relative to local authorities that did not lock down. The difference-in-difference increase in the number of anti-social behavior offences by 66.67 on a base of 424.2 transgressions pre-July across England represents a 15.7 percentage point increase. Authorities subjected to a local lockdown also had a 25.3 percentage point increase in the number of weapons possession relative to no-local lockdown authorities. Figure 7 also displays a statistically significant decrease in other theft violations, by 8 percentage points, in locked down authorities relative to those that did not lockdown. Bicycle thefts are an interesting case because, although not statistically significant based on the difference-in-difference estimation, they first decrease in a statistically significant way in locked down authorities before increasing afterwards. We explore this type of crime in some detail below.

Recall that on 14 October the UK Government has changed the structure of the local lockdown arrangements, moving from a binary—lockdown vs. no lockdown—scheme to a 3-tier system with increased intensity of lockdown rules. To explore the possibility that our results are driven by the structural break caused by the change in the local lockdown scheme, we estimate the difference-in-difference model of equation (5) treating independently the two periods of local lockdown systems.

Table 5 illustrates the coefficient estimates for the two types of structures. Findings are consistent with those in the event study reported in Figure 7, with the bonus that they provide additional information about the version of the local lockdown scheme that was more influential on crime. The binary lockdown scheme was responsible for the increase in anti-social behavior counts (by 23 percentage points) and the decrease in burglaries (by 8 percentage points) in local authorities under a lockdown relative to those without a lockdown, the latter effect only significant at the 10% level. The 3-tier system, on the other hand, was largely the reason behind the decreases in other theft (by 14 percentage points) and public order (by 18 percentage points), and the increase in weapons possession (by 27 percentage points at 10% significance level) in local authorities under strict lockdowns relative to the impact of areas that experience a medium level lockdown. Bicycle theft was the only crime category affected in both lockdown schemes, with the effect being opposite in sign. During the binary scheme bicycle theft declined by 60 percentage points in locked down authorities, and rose by 46 percentage points in the tier system for authorities under the stricter regulations.[9] Overall, based on these findings, it is not evident that a local lockdown scheme was superior to the other in combating criminal activity. Perhaps the addition of further observations, as and when they become available in 2021, can shed further light on this issue.

---

[9] A possible factor behind the reversal in bicycle thefts can be found in Kirchmaier and Villa-Llera (2020) who examine the behavior of crime in areas of England and Wales with differing rates of claimants due to furloughed jobs and unemployment. Specific to bicycle thefts, they find that areas with claimant rates above the country median prior to March and an above-median increase since March 2020, experience an increase in such thefts against all other areas which show a concomitant decrease. Upon close inspection, the high claimant areas in Kirchmaier and Villa-Llera (2020) correspond to the areas under the stricter lockdown rules in the 3-tier system in our dataset. Hence, it is these areas that suffer higher bicycle thefts relative to other local authorities from October onward. The rationale is that the strict lockdown and the associated social distancing increased substantially the value of alternative modes of singular transport, raising the demand for bicycles. In the absence of available bicycles for purchase from shops, as documented in the press (see https://www.bbc.co.uk/news/uk-53023552), the rising economic value of bicycles prompted more thefts for this good.

5.3 Identifying Variation induced by Local Lockdown Treatment Timing

Having established that local lockdowns affect some types of recorded crime, in this section we examine if this impact varies across treatment cohorts. Specifically, we are interested on whether there exists heterogeneity in the estimated treatment effects of local lockdowns between early and late adopters of local lockdown policies. Recent work by Goodman-Bacon (2018) and Callaway and Sant'Anna (2020) emphasized the impact that treatment timing can have on difference-in-difference and event study estimates. In brief, baseline estimates (such as those in Figure 7) can be expressed as the weighted average of the two-period/two-group estimates for each cohort of treatment timing, where the two periods are control and treatment and the two groups are defined by their treatment timing. The difference-in-difference and event study coefficients can then be estimated for each two-group combination. In our case, this translates to separate estimates for early and late adopters of local lockdown policies, both compared against non-adopters (or mild adopters) during lockdowns relative to pre-lockdown periods.

An example of this application is conducted by Crucini and O'Flaherty (2020) in the context of COVID-19-induced stay-at-home orders in US states. Using an event study framework, they find that stay-at-home orders caused a 4 percentage point decrease in consumer spending and hours worked. Introducing heterogeneity in the estimated treatment effects across treatment cohorts in line with the above discussion, they show the decline in hours worked to be driven entirely by early treated states, i.e., states that enacted stay-at-home orders during the first half of the examined period. Late treated states also experience a decline in hours worked, but about half the magnitude of the early treated states, a 2 percentage point decrease. Prompted by this, it is not unlikely that criminal behavior and the ability of the police to record criminal activity can be dependent on the timing an area is put under local lockdown restrictions. To test this hypothesis, we refine the event study specification in equation (4) as follows:

$$C_{amy} = \alpha + \alpha_a + \alpha_{my} + \alpha_{am} + \alpha_{ay} + \tag{6}$$

$$+ \sum_{i=1}^{16} \beta_i^E \theta_i Local_{a,Early} + \sum_{i=17}^{22} \gamma_i^E \theta_i Local_{a,Early} \cdot Local_{M,2020} +$$

$$+ \sum_{i=1}^{16} \beta_i^L \theta_i Local_{a,Late} + \sum_{i=17}^{22} \gamma_i^L \theta_i Local_{a,Late} \cdot Local_{M,2020} + \varepsilon_{amy}.$$

Local lockdown restrictions in England occurred over six months, July to December 2020. We split this period in the middle so local authorities are divided into two groups, those that received local lockdown treatment during July-September (Early) and those that received treatment during October-December (Late).[10] Compared to equation (4), the coefficients of interest γ_i are now allowed to vary across the two groups, γ_i^E and γ_i^L.[11] The former (latter) set of coefficients capture the impact of local authorities that entered a local lockdown early (late) relative to the impact of authorities that did not enter a local lockdown, in month i relative to the monthly average from May 2013-February 2019. The coefficients β_i^E and β_i^L offer a test of the parallel-trends assumption.

Figure 8 plots the results of equation (6) with the early treatment estimates in blue and late treatment in red. The dashed horizontal lines depict the coefficient estimates when in equation (6) we replace *each* of the post-treatment months with a single dummy variable that takes the value of 1 for *all* months $i = 17 - 22$. This helps to better visualize the joint effect of the post-treatment period. For consistency, early treatment single estimates appear in blue and late treatment single estimates in red.

Figure 8 suggests that for half of the crime categories there is no statistically significant difference in crime counts between early and late treated local authorities. That is, for eight types of crime (total crime excluding anti-social behavior, violence and sexual offences, criminal damage and arson, drugs, shoplifting, robbery, theft from the person, and other crime) whether authorities were placed in local lockdown in July to September or October to December plays no role in the response of crime, meaning crime is not statistically different in these two periods compared to the control period of the omitted months May 2013-February 2019. For the remaining eight types of crime, however, the timing of the treatment does matter. Everything else constant, placing an authority in local lockdown restrictions at a late stage reduces crime offences by 6% in burglaries, 7.5% in vehicle theft, by 4.8% in other theft, by 16.3% in bicycle theft, by 11.4% in crime against public order, and by 29% in possession of weapons. An early treatment, on the other hand, has no effect on these offences, when compared to authorities that

---

[10] Note that the treatment groups in this exercise do not fully coincide with those in the previous section which looked at the differential crime effects between two local lockdown schemes, split into before and after 13 October. The current exercise includes all of October into the late treatment group, thus mixing the two lockdown schemes for this month. The treatment in this section is therefore asking a different question, specific to the timing of treatment.

[11] This specification is similar to stratifying the event study by early and late treatment groups.

did not enter a local lockdown, relative to the control period of the omitted months. The only crime type that deviates from this rule is anti-social behavior, which when early treated decreases by 22.7% compared to a rise of 22.2% when treated late. This pattern is also reflected in total crime numbers, decreasing by 5.5% when treated early and rising by 4.6% when treated late. Overall, excluding the crime of anti-social behavior, the findings support a beneficial low-crime effect when local authorities are placed under a lockdown at a later stage.

5.4 Robustness

We briefly discuss the results of robustness analyses which we do not report for saving space, although they are available upon request. All difference-in-difference and event study point estimates are stable and retain their levels of statistical significance if we either exclude from the analysis one-by-one each of the thirty-eight territorial police forces in England or include in the specifications police force-by-month fixed effects.[12] These allow for flexible police force-time trends in comparing the impact across local authorities within the same police force in the same month.

We also perform an exercise specific to local lockdown effects and estimate coefficients by adding region-by-month-by-year fixed effects to compare the impact across local authorities within the same region in the same month and year.[13] This helps address potential concerns relating to the distribution of local lockdowns across England, in particular, the concentration of local lockdowns in the East Midlands, North East, North West, and South East England (see Figures 2 and 3). The results overall are qualitatively robust to the inclusion of these fixed effects.

6. Interpretation of Lockdown Effects: The Economic Cost of Crime

The difference-in-difference and event study estimates presented so far represent the average effect of lockdown policies, national or local, on crime counts for treated local authority-months. In this section, we use the difference-in-difference estimates of the national lockdown

---

[12] Recall that Greater Manchester Police is already excluded from the analysis due to the lack of reporting crime data since before the onset of the pandemic.

[13] England is divided into nine geographic regions: East Midlands, East of England, London, North East, North West, South East, South West, West Midlands, Yorkshire and the Humber.

from Table 3 to estimate the economic benefits to society generated by lower crime, or the economic costs incurred by higher crime, for the treated period March to December 2020.

To undertake this exercise, we use the per-crime costs of the crime categories reported in Heeks et al. (2018) in the most recent calculation of the economic and social costs of crime by the Home Office in England. Table E1 of the report summarizes the unit cost of crimes by category, expressed in 2015/16 prices.[14] The report does not consider the cost of every type of crime, excluding all crimes against society (i.e., crimes that are *not* committed against an individual victim), such as anti-social behaviour, drugs, and public order violations. It also excludes crimes that have a small economic impact on society, such as bicycle theft, weapons possession, or shoplifting. Rather, it concentrates in more serious victim-based offences, likely to have the largest economic and social costs. These include burglary, criminal damage and arson, robbery, theft from the person, motor vehicle theft, violence and sexual offences, and commercial theft. For this reason, our back-of-the-envelope calculations take into account only these seven crime categories out of the total fourteen used in our earlier analysis (we include "commercial theft" in the "other theft" category). We acknowledge this method does not fully account for the economic cost of all types of crime. However, the focus on the most serious offences should be the one carrying the highest impact on society.

Table 6 shows in column (1) the unit cost of each crime type (in 2020 British pound prices). To obtain these amounts, we proceed in two steps. First, from Heeks et al. (2018, Table E1) we calculate the weighted average cost of each crime by combining the unit cost of individual and commercial crime by category.[15] For example, for burglary we multiply the unit cost of domestic burglary (£5,930) by the fraction of domestic burglaries (0.8714) and add the product of the unit cost of commercial burglary (£15,460) by the fraction of commercial burglaries (0.1286). This yields the cost of £7,156 per burglary. Second, we adjust the 2015/16 unit cost of crime prices in Heeks et al. (2018) into 2020 prices. To do this, we use the Consumer Prices Index percentage change in England between the financial years 2015/16 and 2020/21, reported by the Office for Budget Responsibility.[16] During this period, prices have recorded an

---

[14] The unit cost of criminal offences is comprised by three main cost areas: costs in anticipation of crime, costs as a consequence of crime, and costs in response to crime. We use their sum to represent the total unit cost of crime.

[15] This uses the simplifying assumption that the distribution of crimes between individual and commercial is the same between 2015/16 and 2020 as we do not have breakdown crime data between the two types for 2020.

[16] This is found in the November 2020 Supplementary Economy Table 1.7: https://obr.uk/efo/economic-and-fiscal-outlook-november-2020/.

8.44 percentage point increase so that the updated unit cost of burglary is £7,759 in 2020 prices. Similar price adjustments for all other crimes yields column (1) of Table 6.

To calculate the economic effects associated with changes in crime during the lockdown for the average local authority-month, we multiply the per-crime costs in column (1) by the marginal effects from Table 3. The estimates from Table 3 for each of the seven offences are negative and statistically significant, so that the decrease in crimes due to the lockdown generates economic benefits. These are shown in column (2) to range from £19,603 for theft from the person to £556,183 for motor vehicle theft, the latter including both theft of vehicle and theft from vehicle, in a local authority-month. To estimate the economic benefits for the average local authority over the entire lockdown period 16 March-31 December 2020, we multiply the figures in column (2) by the respective number of lockdown months of 9.516, shown in column (3). Finally, column (4) multiplies column (3) estimates by the 307 number of local authorities used in the analysis. This gives rise to the economic benefits owing to the reduction of crime counts for England, by category of crime. The total effect for the country across all crimes can be found by summing the estimated benefit from each crime type. This equates to approximately £4.3 billion. The bracketed terms are calculated by using the upper 95% confidence band and the lower band from our baseline difference-in-difference estimates (Table 3) over the entire post-period. This results in economic gains that range from £3.5 billion to £5.1 billion.

7. Conclusion

The COVID-19 pandemic has transformed the landscape of economic and social activity, including criminal activity. In this paper, we examine the effect of lockdown policies on recorded crime across fourteen crime categories using difference-in-difference and event study methods for local authorities in England. The implementation of two national lockdowns between March and December 2020 in the country, and their subsequent withdrawal during which lockdowns were activated quasi-randomly at the local authority level, allow for a comprehensive analysis of the different types of lockdowns and the effect they exert on crime. Further, the use of high-frequency, monthly crime data from the Police UK dating back to May 2013 introduces variation, over time and across outcome measures, invaluable in evaluating the impact of the outbreak.

We find that as consequence of the pandemic, all criminal activity has declined considerably during the months of national lockdowns in England, with the exception of the so-called crimes against society (e.g., anti-social behavior, drug, and public order offences) which registered increases. Exiting a national lockdown moderated the change in recorded crime but kept it in line with that observed under a lockdown. We also show that lockdowns applied locally and with strict measures to combat the spread of the coronavirus in a concerted effort, have not had as wide and strong effects on criminal behavior compared to areas where lockdowns were absent or mild. Specifically, local lockdowns induced increases in anti-social behavior and weapons possession offences, while they only led to lower incidences of bicycle and other theft. A further analysis, distinguishing the timing of the treatment between early and late entries to local restrictions, revealed that the impact of local lockdowns was operated by the areas that locked down at a late stage, i.e., from October to December 2020. Moreover, when allowing for a treatment that discriminated between the two local lockdown schemes introduced in England before and after 13 October 2020, we did not observe significant differences in the way they have affected crime.

Our results provide a crucial first step on measuring the impact of COVID-19 on recorded crime in England. The findings are important because they also offer the opportunity to monetize the cost or benefit arising from the change in criminal behavior. Back-of-the-envelope calculations suggest that the national lockdown generated substantial economic benefits to society in the form of lower crime. Using the marginal effects we obtain from Table 3, and per-crime costs of various crime categories reported by Heeks et al. (2018), we estimate lower crime costs induced by COVID-19 of approximately £4.3 billion (in 2020 prices). Moreover, we note that these estimates may be conservative given that the fall in recorded drug and shoplifting violations, not taken into account in the calculations, may generate further decreases in the size of economic costs.

References

Abrams, D.S., 2021. COVID and crime: An early empirical look. Journal of Public Economics 194, 104344.

Allcott, H., Boxell, L., Conway, J.C., Ferguson, B.A., Gentzkow, M., Goldman, B., 2020. What explains temporal and geographic variation in the early US coronavirus pandemic? NBER Working Paper No. 27965.

Agüero, J.M., 2021. COVID-19 and the rise of intimate partner violence. World Development 137, 105217.

Arenas-Arroyo, E., Fernandez-Kranz, D., Nollenberger, N., 2021. Intimate partner violence under forced cohabitation and economic stress: Evidence from the COVID-19 pandemic. Journal of Public Economics 194, 104350.

Becker, G.S., 1968. Crime and punishment: An economic approach. Journal of Political Economy, 76(2), 169-217.

Binder, C., 2020. Coronavirus fears and macroeconomic expectations. Review of Economics and Statistics 102(4), 721-730.

Bullinger, L.R., Carr, J., Packham, A., 2020. COVID-19 and crime: Effects of stay-at-home orders on domestic violence. NBER Working Paper No. 27667.

Cabinet Office, 2020. Staying at home and away from others. https://www.gov.uk/government/publications/full-guidance-on-staying-at-home-and-away-from-others/full-guidance-on-staying-at-home-and-away-from-others. Accessed 19 Jan 2021.

Callaway, B., Sant'Anna, P.H.C., 2021. Difference-in-Differences with multiple time periods. Journal of Econometrics, forthcoming.

Campedelli, G-M,, Aziani, A., Favarin, S., 2020a. Exploring the effect of 2019-NCoV containment policies on crime: The Case of Los Angeles, American Journal of Criminal Justice, forthcoming.

Campedelli, G-M., Favarin, S., Aziani, A., Piquero, A.R., 2020b. Disentangling community-level changes in crime trends during the COVID-19 pandemic in Chicago. Crime Science 9, Article No 21.

Chetty, R., Friedman, J.N., Hendren, N., Stepner, M., 2020. How did COVID-19 and stabilization policies affect spending and employment? A new real-time economic tracker based on private sector data. NBER Working Paper No. 27431.

Crucini, M.J., O'Flaherty, O., 2020. Stay-at-home orders in a fiscal union. NBER Working Paper No. 28182.

Department of Health and Social Care, 2020. Local COVID alert levels: what you need to know. https://web.archive.org/web/20201014194215/http://gov.uk/guidance/local-covid-alert-levels-what-you-need-to-know. Accessed 19 Jan 2021.

Goodman-Bacon, A., 2018. Difference-in-Differences with variation in treatment timing. NBER Working Paper No. 25018.

Heeks, M., Reed, S., Tafsiri, M., Prince, S., 2018. The economic and social costs of crime. The Home Office, Research Report No. 99.

Kirchmaier, T., Villa-Llera, C., 2020. Covid-19 and changing crime trends in England and Wales. Centre for Economic Performance Working Paper No. 13.

Kong, E., Prinz, D., 2020. Disentangling policy effects using proxy data: Which shutdown policies affected unemployment during the COVID-19 pandemic? Journal of Public Economics, 9, 104257.

Leslie, E., Wilson, R., 2020. Sheltering in place and domestic violence: Evidence from calls for service during COVID-19. Journal of Public Economics 189, 104241.

Miller, A.R., Segal, C., Spencer, M.K., 2020. Effects of the COVID-19 pandemic on domestic violence in Los Angeles. NBER Working Paper No. 28068.

Santiago, P-V., Carreras, E., Gibbons, M.A., Murphy, T.E., Rossi, M., 2020. COVID-19 lockdowns and domestic violence: Evidence from two studies in Argentina. Universidad de San Andres Working Paper No 143.

Silverio-Murillo, A., Balmori de la Miyar, J.R., Hoehn-Velasco, L., 2020. Families under confinement: COVID-19, domestic violence, and alcohol consumption. SSRN Scholarly Paper ID 3688384.

Poblete-Cazenave, R., 2020. Criminality and lockdowns. COVID Economics, Issue 29.

Public Health England, 2020 No. 685. The Health Protection (Coronavirus, Restrictions) (Leicester) Regulations 2020. https://www.legislation.gov.uk/uksi/2020/685/contents/made. Accessed 19 Jan 2021.

Ravindran, S., Shah, M., 2020. Unintended consequences of lockdowns: COVID-19 and the shadow pandemic. NBER Working Paper No. 27562.

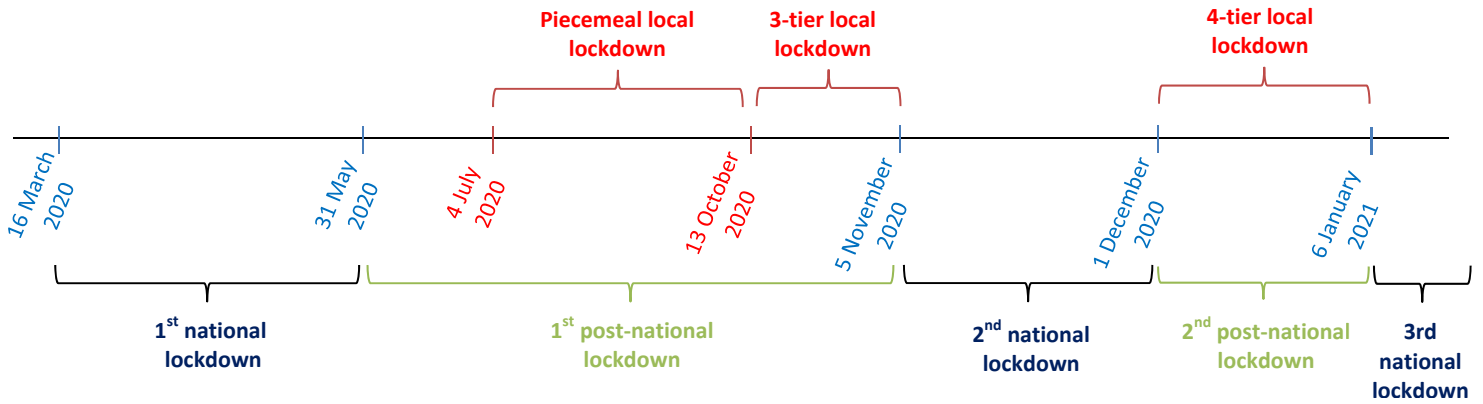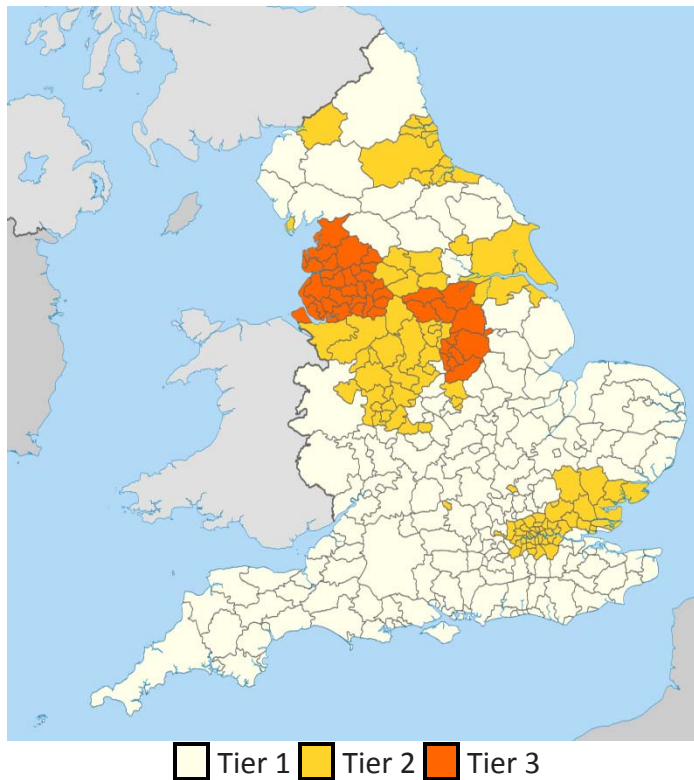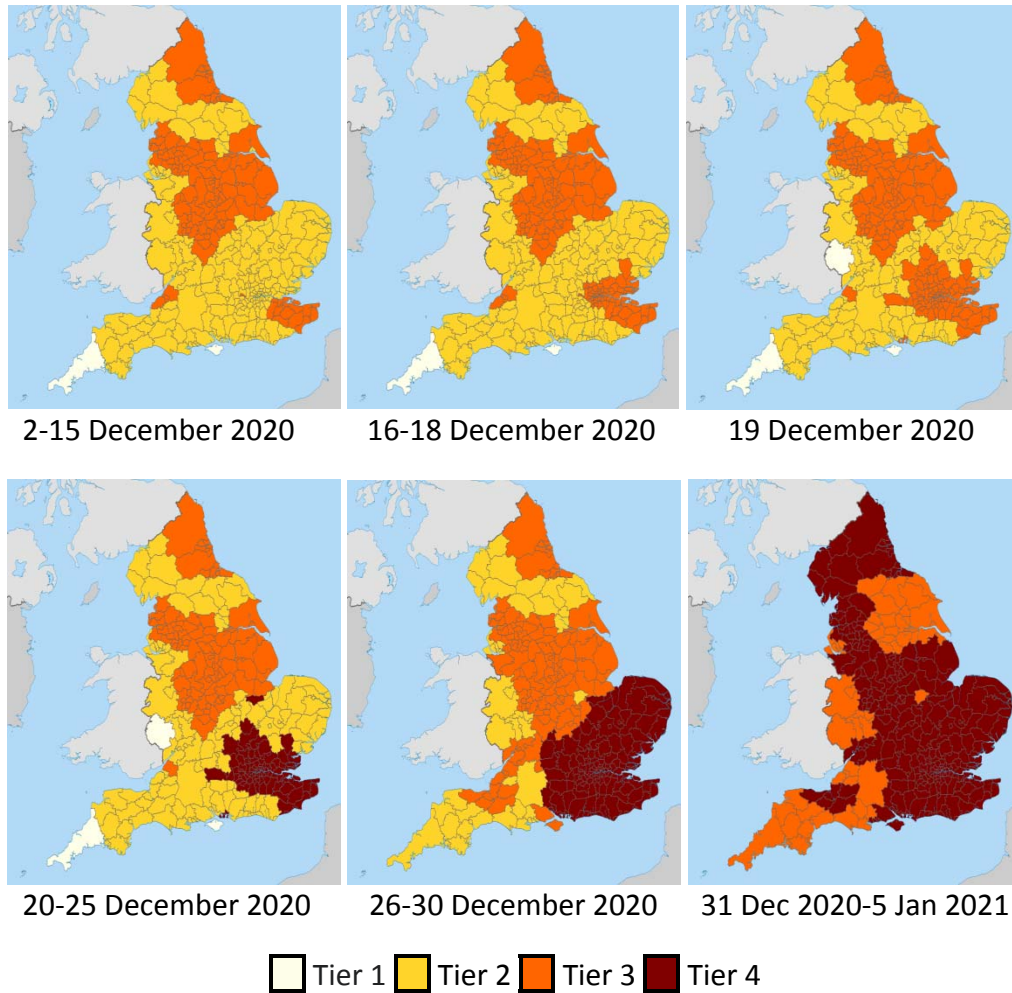**Figure 1. Timeline of National and Local Lockdowns in England**

Piecemeal local lockdown

3-tier local lockdown

4-tier local lockdown

16 March 2020

31 May 2020

4 July 2020

13 October 2020

5 November 2020

1 December 2020

6 January 2021

1st national lockdown

1st post-national lockdown

2nd national lockdown

2nd post-national lockdown

3rd national lockdown

Figure 2. COVID-19 tiers by local authority, 31 October 2020

Tier 1   Tier 2   Tier 3

Note: The figure plots lower tier local authorities in England based on the three tiers of local restrictions defined by the Government.

Figure 3. COVID-19 tiers by local authority, 2 December 2020-5 January 2021

2-15 December 2020

16-18 December 2020

19 December 2020

20-25 December 2020

26-30 December 2020

31 Dec 2020-5 Jan 2021

☐ Tier 1 ☐ Tier 2 ☐ Tier 3 ☐ Tier 4

Note: The figure plots lower tier local authorities in England based on the four tiers of local restrictions defined by the Government. Tier 4 was introduced on 20 December 2020.

Figure 4. Crime response to lockdown
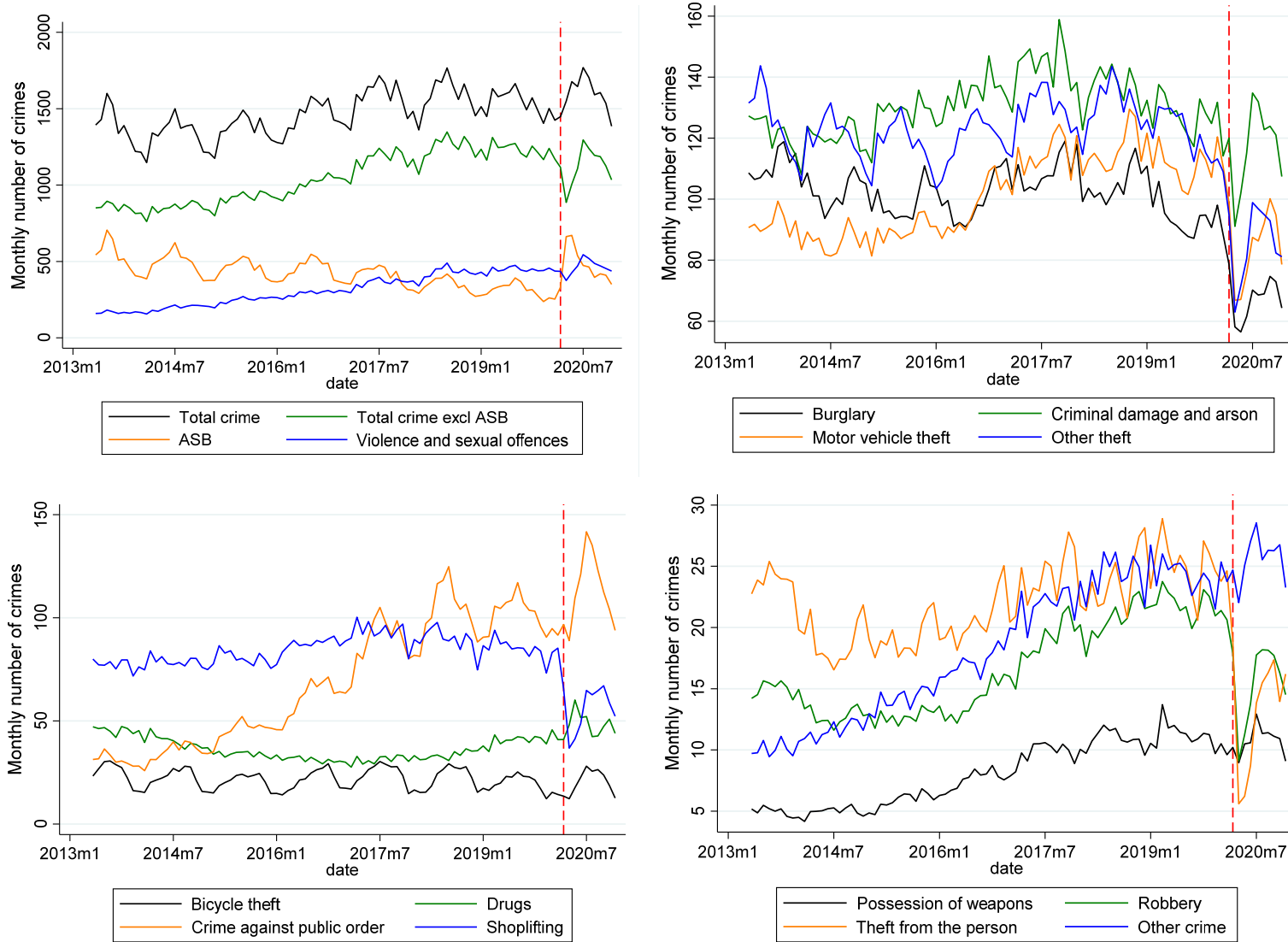
Note: The figure plots the local authority mean monthly number of reported crimes by crime category from May 2013 to December 2020. The vertical red dashed line denotes March 2020 when the lockdown started in England. Data are from Police UK.

# Figure 5. Crime response to local lockdown
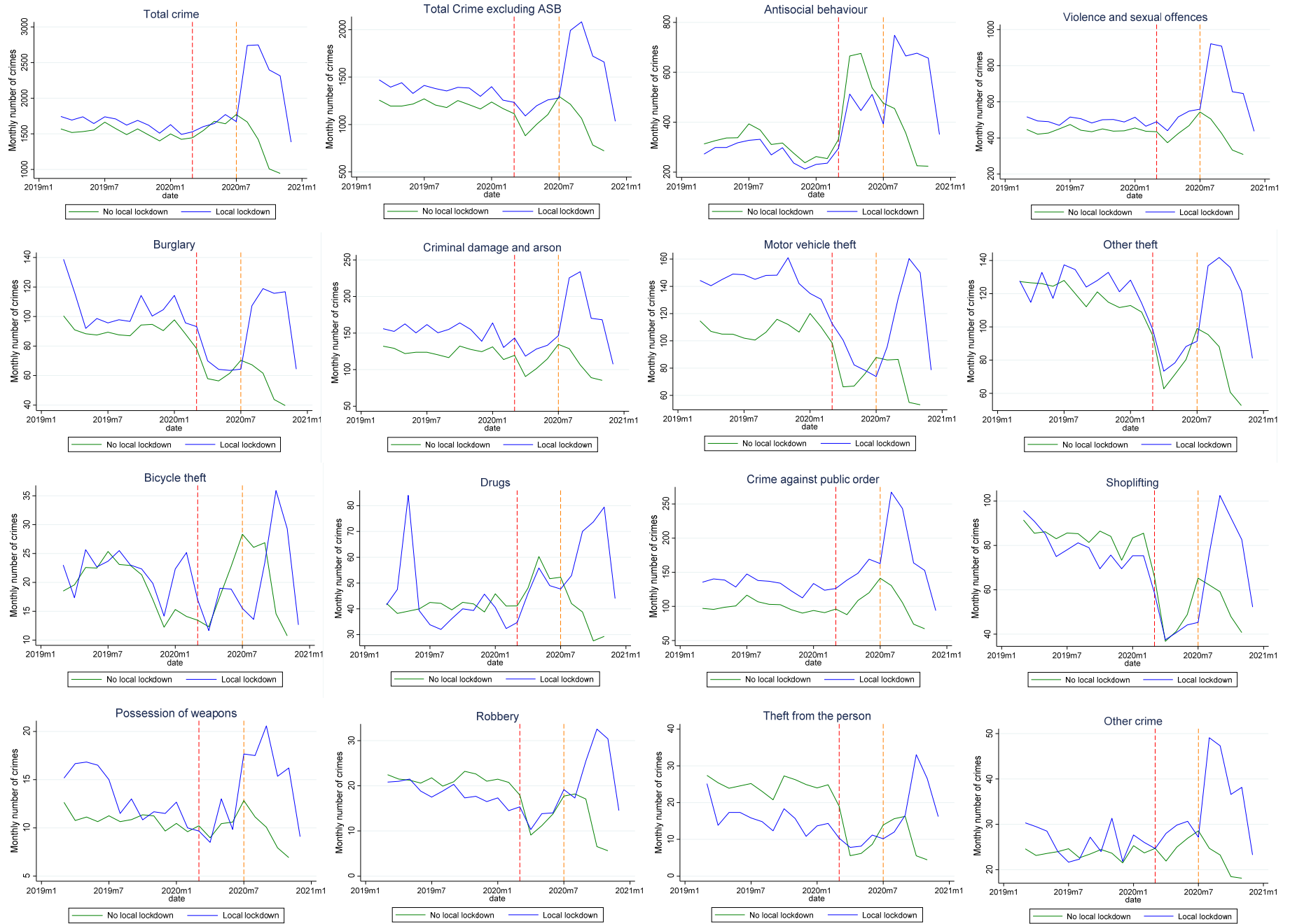
Note: The figure plots the local authority mean monthly number of reported crimes by crime category from March 2019 to December 2020. The count of crimes is presented by local lockdown group: No Local Lockdown (in green) vs. Local Lockdown (in blue). The vertical (orange) red dashed line denotes March (July) 2020 when the (local) lockdown started in England. Data are from Police UK.

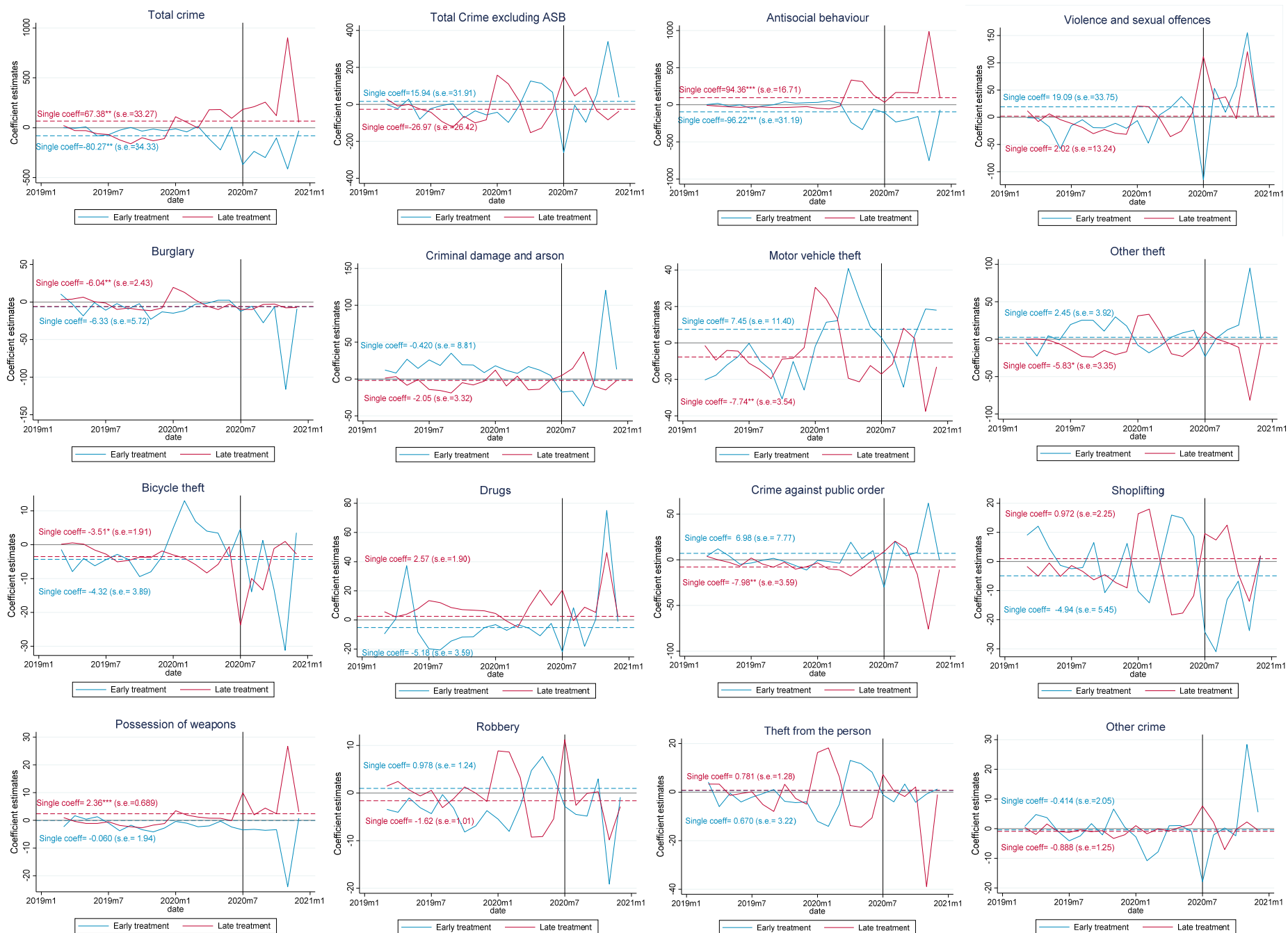# Figure 6. Event study plots: effect of national lockdown policies on crime
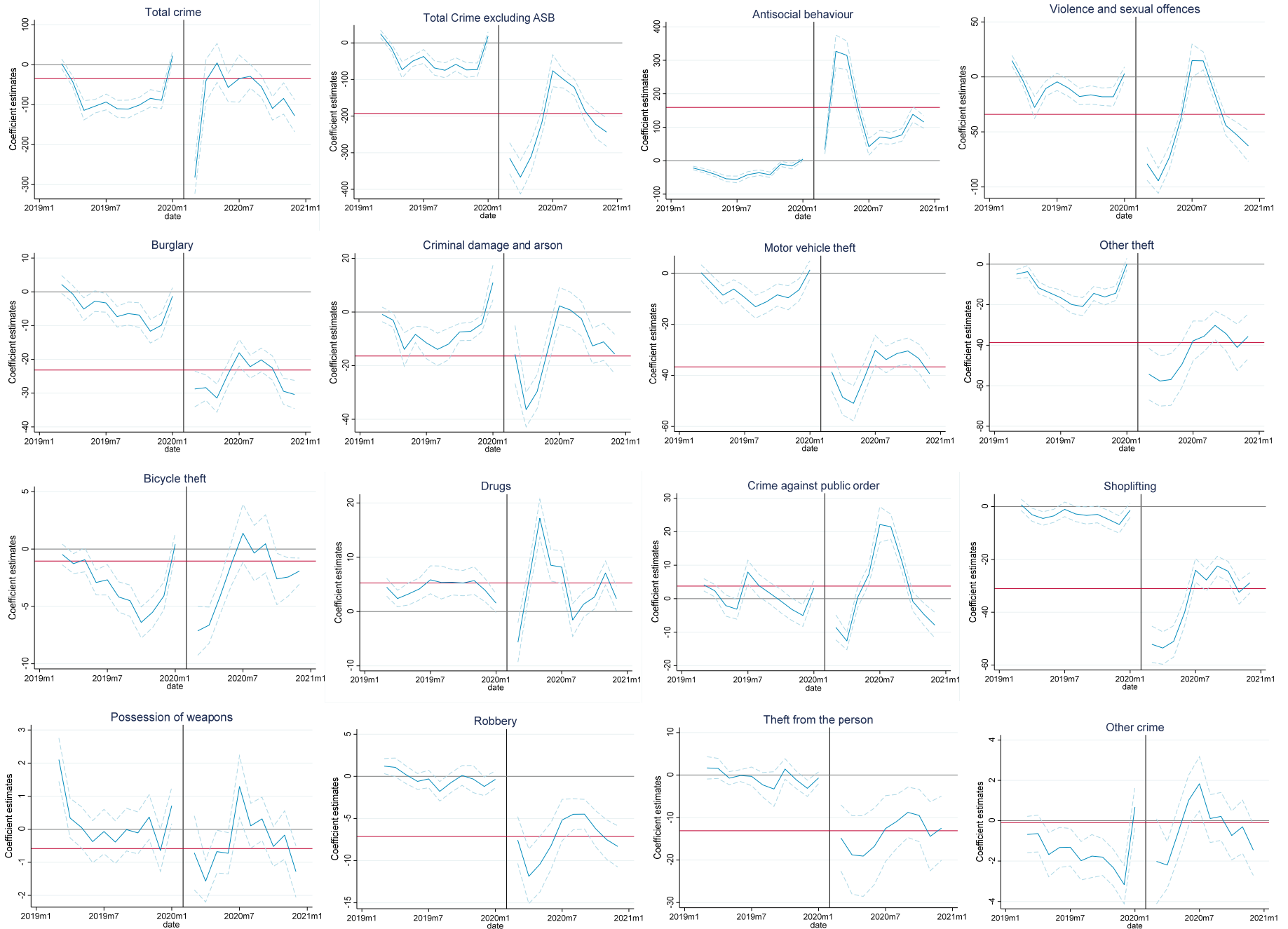
Note: This figure plots the lockdown event study coefficients based on equation (3). The sample includes 307 lower tier local authorities in England—with ten Greater Manchester authorities excluded due to lack of data—and covers the period May 2013 to December 2020. Plot names represent the dependent variable in a local authority-month-year. Local authority, month, year, local authority-by-month, and local authority-by-year fixed effects are included. Dashed lines represent 95% confidence intervals using robust standard errors clustered by local authority. The red line plots the difference-in-difference estimate from Table 3. The omitted month, marked with a vertical line, is the month of February 2020, a month before the implementation of the March lockdown.

Figure 7. Event study plots: effect of local lockdown policies on crime
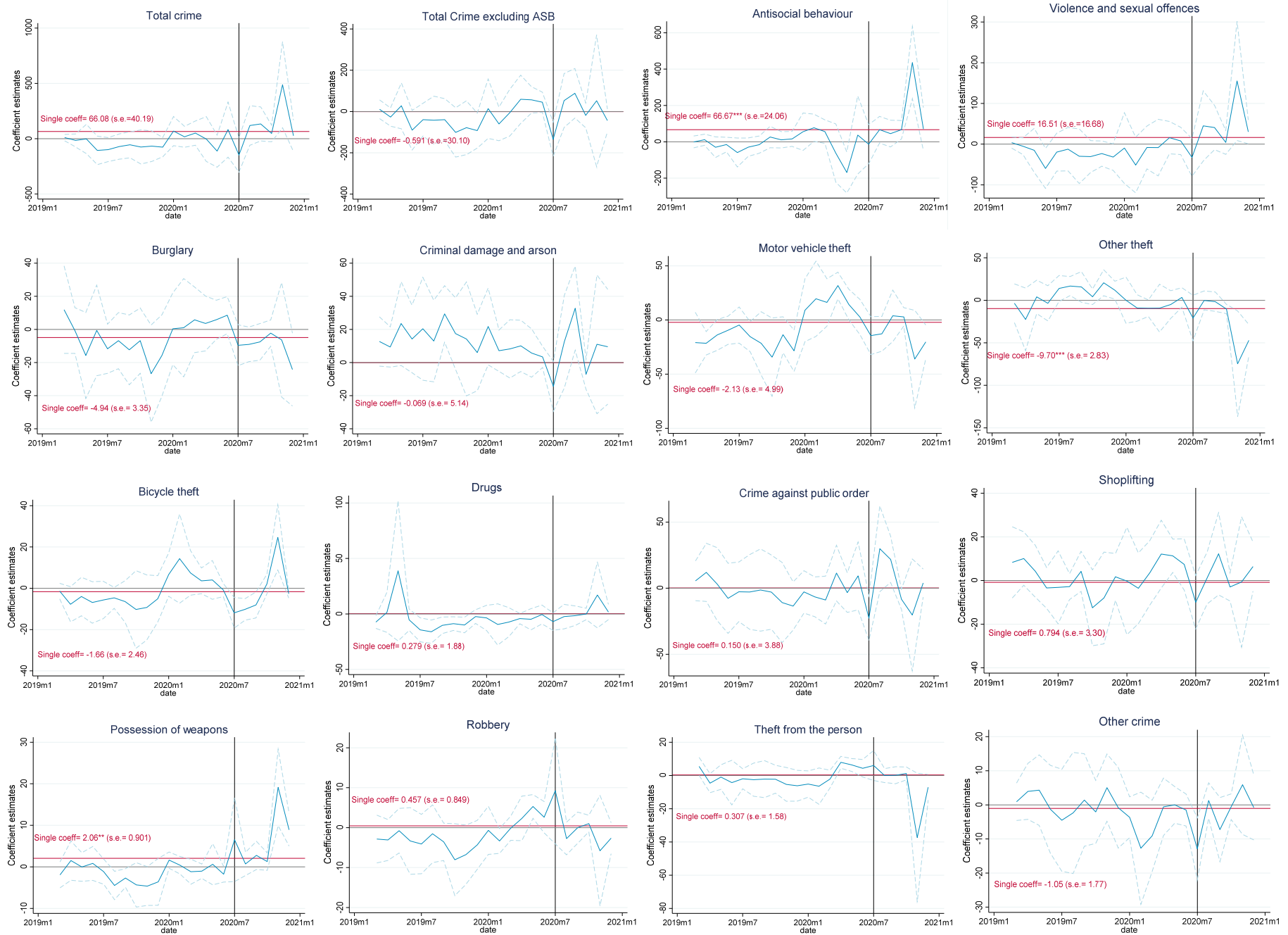
Note: This figure plots the local lockdown event study coefficients based on equation (4). The sample includes 307 lower tier local authorities in England—with ten Greater Manchester authorities excluded due to lack of data—and covers the period May 2013 to December 2020. Plot names represent the dependent variable in a local authority-month-year. Local authority, month-by-year, local authority-by-month, and local authority-by-year fixed effects are included. Dashed lines represent 95% confidence intervals using robust standard errors clustered by local authority. The red line plots the difference-in-difference estimate. The vertical line represents the month of July 2020, when local lockdowns started being implemented.

Figure 8. Event study plots: effect of local lockdown policies on crime based on treatment timing

Note: This figure plots the local lockdown event study coefficients based on equation (6). The sample includes 307 lower tier local authorities in England—with ten Greater Manchester authorities excluded due to lack of data—and covers the period May 2013 to December 2020. Plot names represent the dependent variable in a local authority-month-year. Treated local authorities are divided into two groups: Treatment occurred during July-September 2020 (Early, blue), Treatment occurred during October-December 2020 (Late, red). Local authority, month-by-year, local authority-by-month, and local authority-by-year fixed effects are included. Estimates based on robust standard errors clustered by local authority. The dashed horizontal lines plot the single estimates for Early-treated and Late-treated groups over July-December 2020. The vertical line represents the month of July 2020, when local lockdowns started being implemented.

Table 1. Reported crimes before, during, and after national lockdowns

Mean/SD	Pre-Lockdown	Lockdown	Post-Lockdown	% Difference (2)-(1)	% Difference (3)-(1)
	(1)	(2)	(3)	(4)	(5)
Total crime	1,417	1,514	1,586.9	0.07	0.11
	(1269)	(1355)	(1429)		
Total crime excl ASB	1,012	1,030	1,154.7	0.02	0.13
	(967)	(988)	(1089)		
Anti-social behaviour (ASB)	405.2	484.3	432.2	0.18	0.06
	(375.1)	(499.8)	(406.4)		
Bicycle theft	21.41	14.89	22.19	-0.36	0.04
	(29.3)	(22.6)	(37.8)		
Burglary	98.26	65.86	67.76	-0.40	-0.37
	(99.7)	(72.1)	(75.2)		
Criminal damage and arson	125.8	107.9	121.2	-0.15	-0.04
	(111)	(99.9)	(109.7)		
Drugs	36.01	48.59	46.36	0.30	0.25
	(42.9)	(59.5)	(57.9)		
Possession of weapons	7.75	9.89	10.88	0.24	0.34
	(9.47)	(11.8)	(13.1)		
Crime against public order	64.04	98.29	116.8	0.43	0.60
	(80.3)	(107.1)	(124.4)		
Robbery	15.94	13.75	16.33	-0.15	0.02
	(33.3)	(27.6)	(30.8)		
Shoplifting	82.93	50.81	59.21	-0.49	-0.34
	(79.0)	(49.2)	(54.6)		
Theft from the person	21.24	12.07	14.24	-0.57	-0.40
	(61.5)	(38.3)	(37.3)		
Motor vehicle crime	97.91	80.92	86.59	-0.19	-0.12
	(113.2)	(98.5)	(105.8)		
Violence and sexual offences	302.9	424.5	478.5	0.34	0.46
	(306.6)	(418.0)	(463.2)		
Other theft	120.6	78.35	88.66	-0.43	-0.31
	(128.2)	(77.1)	(86.2)		
Other crime	17.35	24.26	25.85	0.34	0.40
	(19.7)	(25.3)	(26.3)		
Number of observations	25,174	1,529	2,143	26,703	27,137

Notes: This table presents means and standard deviations for total crime and all its subcategories at the local authority-month level by national lockdown status. "Pre-Lockdown" covers from May 2013 to February 2020, "Lockdown" includes the national lockdown dates from 16 March to 31 May 2020 and 5 November to 1 December 2020, and "Post-Lockdown" includes the post-national lockdown dates 1 June to 4 November 2020 and 2 to 31 December 2020. The fourth column reports the percentage difference in means between the "Lockdown" and "Pre-Lockdown" groups, while the last column reports the percentage difference in means between the "Post-Lockdown" and "Pre-Lockdown" groups.

Table 2. Reported crimes across tiers during local lockdowns

Mean/SD	No Local Lockdown	Local Lockdown July-Oct	Tiers 2-4	% Difference (2)-(1)	% Difference (3)-(1)
	(1)	(2)	(3)	(4)	(5)
Total crime	1,427.6	2,731	1,803.9	0.65	0.23
	(1251)	(2482)	(1620)		
Total crime excl ASB	1,057.2	2,015	1,315.1	0.65	0.22
	(930.4)	(2074)	(1265)		
Anti-social behaviour	370.4	715.9	488.8	0.66	0.28
	(364.7)	(504.8)	(432.4)		
Bicycle theft	22.61	21.94	21.38	-0.03	-0.06
	(40.02)	(29.9)	(35.15)		
Burglary	58.73	117.8	86.60	0.70	0.39
	(61.24)	(138.8)	(94.45)		
Criminal damage and arson	112.4	228	134.1	0.71	0.18
	(94.4)	(204)	(126.6)		
Drugs	39.16	69.27	57.55	0.57	0.39
	(48.14)	(101.9)	(65.8)		
Possession of weapons	10.11	20.05	11.94	0.69	0.17
	(10.9)	(25.4)	(15.9)		
Crime against public order	108.7	231.1	121.2	0.75	0.11
	(109.7)	(240.6)	(130.7)		
Robbery	14.11	24.71	21.84	0.56	0.44
	(27.57)	(48.8)	(37.6)		
Shoplifting	56.64	94.52	67.61	0.51	0.18
	(51.3)	(93.8)	(61.3)		
Theft from the person	12.03	14.72	21.86	0.20	0.60
	(32.1)	(21.4)	(52.7)		
Motor vehicle crime	76.28	126.9	111.7	0.51	0.38
	(91.6)	(170.1)	(128.6)		
Violence and sexual offences	440.4	882.4	528.5	0.70	0.18
	(384.3)	(919.1)	(543.8)		
Other theft	82.72	136.1	101.6	0.50	0.21
	(80.8)	(130.7)	(97.1)		
Other crime	23.17	48.10	29.21	0.73	0.23
	(21.9)	(48.7)	(31.1)		
Number of observations	1,208	92	574	1,300	1,782

Notes: This table presents means and standard deviations for total crime and all its subcategories at the local authority-month level by local lockdown status. "No Local Lockdown" refers to local authorities that did not experience a local lockdown during 4 July to 13 October and were under a mild local lockdown from 14 October to 31 December 2020, "Local Lockdown July-Oct" refers to local authorities that experienced a local lockdown during the piecemeal lockdown period of 4 July to 13 October 2020, and "Tiers 2-4" refers to local authorities that experienced a Tier 2, Tier 3 or Tier 4 local lockdown between 14 October to 31 December 2020. The fourth column reports the percentage difference in means between the "Local Lockdown July-Oct" and "No Local Lockdown" groups, while the last column reports the percentage difference in means between the "Tiers 2-4" and "No Local Lockdown" groups.

Table 3. Difference-in-Difference estimates of lockdown policies on crime

Panel A	Total crime	Total crime excl ASB	Anti-social behaviour	Bicycle theft	Burglary	Criminal damage and arson	Drugs	Possession of weapons
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lockdown	-33.61**	-192.8***	159.2***	-1.05	-23.16***	-16.39***	5.27***	-0.585***
	(15.78)	(14.57)	(11.71)	(0.748)	(1.58)	(1.78)	(0.892)	(0.211)
Local authority fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (adjusted)	0.989	0.987	0.949	0.911	0.960	0.963	0.924	0.867
Observations	28,238	28,238	28,238	28,238	28,238	28,238	28,238	28,238
Dependent variable pre-lockdown mean	1463.7	1045.4	418.3	21.85	102.5	130.4	36.34	8.04
Dependent variable during lockdown change (in %)	-2.29%	-18.44%	38.06%	0%	-22.60%	-12.57%	14.50%	-7.28%

Panel B	Crime against public order	Robbery	Shoplifting	Theft from the person	Motor vehicle theft	Violence and sexual offences	Other theft	Other crime
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Lockdown	3.78***	-7.13***	-31.06***	-13.10***	-36.66***	-34.03***	-38.62***	-0.096
	(1.15)	(1.17)	(2.03)	(3.55)	(2.48)	(3.42)	(4.39)	(0.400)
Local authority fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (adjusted)	0.961	0.948	0.950	0.922	0.958	0.981	0.966	0.911
Observations	28,238	28,238	28,238	28,238	28,238	28,238	28,238	28,238
Dependent variable pre-lockdown mean	68.32	16.70	84.57	22.12	101.4	311.6	123.4	18.07
Dependent variable change during lockdown (in %)	5.53%	-42.70%	-36.72%	-59.22%	-36.15%	-10.92%	-31.30%	0%

Notes: This table shows differences-in-differences estimates of the lockdown based on equation (1). The sample includes 307 lower tier local authorities in England—with ten Greater Manchester authorities excluded due to lack of data—and covers the period May 2013 to December 2020. Column names represent the dependent variable in a local authority-month-year. The treatment variable is an indicator for the period during a month which a lockdown is effective. Coefficients are listed in the row and robust standard errors are reported in the row below in parentheses. Constant term not reported. "Yes" indicates that the set of fixed effects is included. Dependent variable change during lockdown (in %) denotes the change in crime during the lockdown against the mean value of crime pre-lockdown, calculated as the ratio between the coefficient estimate of Lockdown and the pre-lockdown mean of crime. Standard errors are clustered by local authority. ***, **, * denote significance at the 1%, 5%, 10% level, respectively.

Table 4. Difference-in-Difference estimates of national and post-national lockdown policies on crime

Panel A	Total crime	Total crime excl ASB	Anti-social behaviour	Bicycle theft	Burglary	Criminal damage and arson	Drugs	Possession of weapons
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
National lockdown	-28.60	-310.3***	281.6***	-4.37***	-28.61***	-31.61***	9.48***	-1.25***
	(21.97)	(20.13)	(19.66)	(0.633)	(1.82)	(2.08)	(1.14)	(0.223)
Post-national lockdown	-35.42**	-150.3***	114.9***	0.143	-21.19***	-10.86***	3.74***	-0.343
	(14.63)	(13.12)	(9.63)	(0.894)	(1.56)	(1.78)	(0.926)	(0.235)
Local authority fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (adjusted)	0.989	0.988	0.954	0.912	0.961	0.965	0.925	0.867
Observations	28,238	28,238	28,238	28,238	28,238	28,238	28,238	28,238
Dependent variable pre-lockdown mean	1463.7	1045.4	418.3	21.85	102.5	130.4	36.34	8.04
Dependent variable change national lockdown (in %)	0%	-29.68%	67.32%	-20%	-27.91%	-24.24%	26.09%	-15.55%
Dependent variable change post-national lockdown (in %)	-2.42%	-14.38%	27.46%	0%	-20.67%	-8.33%	10.29%	0%
National lockdown = Post-national lockdown (p-value)	0.618	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel B	Crime against public order	Robbery	Shoplifting	Theft from the person	Motor vehicle theft	Violence and sexual offences	Other theft	Other crime
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
National lockdown	-7.71***	-10.17***	-45.57***	-17.53***	-44.90***	-75.49***	-51.32***	-1.20***
	(1.09)	(1.51)	(2.73)	(4.38)	(3.03)	(4.14)	(5.75)	(0.434)
Post-national lockdown	7.95***	-6.03***	-25.80***	-11.49***	-33.67***	-18.99***	-34.02***	0.303
	(1.32)	(1.06)	(1.84)	(3.26)	(2.36)	(3.71)	(3.91)	(0.416)
Local authority fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (adjusted)	0.962	0.948	0.952	0.922	0.958	0.982	0.967	0.911
Observations	28,238	28,238	28,238	28,238	28,238	28,238	28,238	28,238
Dependent variable pre-lockdown mean	68.32	16.70	84.57	22.12	101.4	311.6	123.4	18.07
Dependent variable change national lockdown (in %)	-11.29%	-60.90%	-53.88%	-29.60%	-44.28%	-24.23%	-41.59%	-6.64%
Dependent variable change post-national lockdown (in %)	11.64%	-36.11%	-30.51%	-19.40%	-33.21%	-6.10%	-27.57%	0%
National lockdown = Post-national lockdown (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: This table shows differences-in-differences estimates of the national lockdown and post-national lockdown based on equation (2). The sample includes 307 lower tier local authorities in England—with ten Greater Manchester authorities excluded due to lack of data—and covers the period May 2013 to December 2020. Column names represent the dependent variable in a local authority-month-year. The treatment variables are indicators for the periods during a month which a national lockdown and post-national lockdown are effective. Coefficients, jointly estimated in the same regression, are listed in the row and robust standard errors are reported in the row below in parentheses. Constant term not reported. "Yes" indicates that the set of fixed effects is included. Dependent variable change national [post-national] lockdown (in %) denotes the change in crime during the national [post-national] lockdown against the mean value of crime pre-lockdown, calculated as the ratio between the coefficient estimate of National lockdown [Post-national lockdown] and the pre-lockdown mean of crime. National lockdown = Post-national lockdown (p-value) denotes an equivalence test of the two coefficient estimates. Standard errors are clustered by local authority. ***, **, * denote significance at the 1%, 5%, 10% level, respectively.

Table 5. Difference-in-Difference estimates of local lockdown policies on crime

Panel A	Total crime	Total crime excl ASB	Anti-social behaviour	Bicycle theft	Burglary	Criminal damage and arson	Drugs	Possession of weapons
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Piecemeal local lockdown	114.9*	16.46	98.46***	-12.90***	-8.29*	8.35	1.91	1.91
	(66.97)	(46.83)	(36.17)	(3.56)	(4.64)	(10.10)	(2.94)	(1.31)
Tier 2-4 local lockdown	15.83	-18.13	33.97	9.90***	-1.51	-8.73	-1.39	2.22*
	(43.43)	(33.26)	(30.85)	(3.70)	(5.24)	(6.17)	(4.53)	(1.15)
Local authority fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (adjusted)	0.990	0.989	0.960	0.915	0.961	0.966	0.927	0.869
Observations	28,238	28,238	28,238	28,238	28,238	28,238	28,238	28,238
Dependent variable pre-local lockdown mean	1468.7	1044.5	424.2	21.60	100.7	129.3	36.96	8.13
Dependent variable change piecemeal local lockdown (in %)	7.82%	0%	23.21%	-59.72%	-8.23%	0%	0%	0%
Dependent variable change tier 2-4 local lockdown (in %)	0%	0%	0%	45.83%	0%	0%	0%	27.31%

Panel B	Crime against public order	Robbery	Shoplifting	Theft from the person	Motor vehicle theft	Violence and sexual offences	Other theft	Other crime
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Piecemeal local lockdown	12.72	0.191	-0.642	-3.37	-8.40	29.04	-2.69	-1.36
	(8.07)	(1.30)	(5.64)	(2.38)	(8.81)	(27.51)	(3.96)	(2.53)
Tier 2-4 local lockdown	-12.77**	0.730	-0.950	4.09	4.31	3.62	-16.91***	-0.734
	(5.69)	(1.66)	(3.73)	(3.81)	(6.21)	(15.79)	(4.20)	(1.97)
Local authority fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local authority x year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (adjusted)	0.965	0.949	0.953	0.923	0.959	0.984	0.968	0.912
Observations	28,238	28,238	28,238	28,238	28,238	28,238	28,238	28,238
Dependent variable pre-local lockdown mean	69.91	16.53	82.91	21.56	100.3	316.8	121.3	18.36
Dependent variable change piecemeal local lockdown (in %)	0%	0%	0%	0%	0%	0%	0%	0%
Dependent variable change tier 2-4 local lockdown (in %)	-18.27%	0%	0%	0%	0%	0%	-13.94%	0%

Notes: This table shows differences-in-differences estimates of the two schemes of local lockdown based on equation (5). The sample includes 307 lower tier local authorities in England—with ten Greater Manchester authorities excluded due to lack of data—and covers the period May 2013 to December 2020. Column names represent the dependent variable in a local authority-month-year. The treatment variables are indicators for the periods during a month which a piecemeal or tier 2-4 local lockdowns are effective. Coefficients, jointly estimated in the same regression, are listed in the row and robust standard errors are reported in the row below in parentheses. Constant term not reported. "Yes" indicates that the set of fixed effects is included. Dependent variable change piecemeal [tier 2-4] local lockdown (in %) denotes the change in crime during the piecemeal [tier 2-4] local lockdown against the mean value of crime pre-local lockdown, calculated as the ratio between the coefficient estimate of Piecemeal local lockdown [Tier 2-4 local lockdown] and the pre-local lockdown mean of crime. Standard errors are clustered by local authority. ***, **, * denote significance at the 1%, 5%, 10% level, respectively.

Table 6. Economic effects of lockdown policies on crime

	Estimated unit cost of crime (2020 prices)	Estimated benefit of crime due to lockdown in		
		Local authority-by-month	Local authority	England
	(1)	(2)	(3)	(4)
Burglary	£7,759	£179,704	£1,710,092	£524,998,355
Criminal damage and arson	£10,602	£173,777	£1,653,684	£507,681,279
Robbery	£13,923	£99,272	£944,694	£290,021,108
Theft from the person	£1,496	£19,603	£186,546	£57,269,639
Motor vehicle theft	£15,171	£556,183	£5,292,718	£1,624,864,564
Violence and sexual offences	£11,668	£397,094	£3,778,799	£1,160,091,516
Other theft	£1,051	£40,621	£386,562	£118,674,681
Total Effect		£1.466 million [1.2, 1.7]	£13.953 million [11.4, 16.5]	£4.283 billion [3.5, 5.1]

Notes: This table presents the economic benefit associated with changes in recorded crime by category due to the lockdown. Column (1) shows the estimated unit cost of crime based on Heeks et al. (2018, Table E1), adjusted to 2020 prices (by using the 8.44 percentage point increase in the Consumer Prices Index between the financial years 2015/16 and 2020/21 reported in the Office for Budget Responsibility in the November 2020 Supplementary Economy Table 1.7). Columns (2)-(4) show the economic benefits accrued due to reduced crime numbers in, respectively, a local authority for each lockdown month, a local authority across all lockdown months, the whole of England across all lockdown months. The figures in column (2) are obtained by multiplying the estimated unit cost of crime from column (1) by the difference-in-difference coefficient estimates from Table 3. The figures in column (3) are obtained by multiplying column (2) by the number of months the country has been in lockdown during 16 March to 31 December 2020 (9.516). The figures in column (4) are obtained by multiplying column (3) by the 307 local authorities used in the analysis. The last row presents the total effect by summing the economic benefit arising from each individual crime category. Numbers in brackets present the confidence interval for the calculated total effect by using the 95% lower and upper confidence bands for the difference-in-difference coefficients.