Offline crime may go back to normal, cyber won’t: Interrupted time-series analysis during COVID-19

Ideas

Interrupted time series analysis + counterfactuals: https://ds4ps.org/pe4ps-textbook/docs/p-020-time-series.html#the-counterfactual

Focus in Northern Ireland

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# Acknowledgements

# Abstract

# Keywords

Coronavirus; Fraud; Counterfactuals; Temporal; Routine activities; Cyber-enabled

# Introduction

Intro to covid, social changes and crime/cyber

Describe lockdowns in NI

Aims of paper

Distribution of paper

# Rapid social changes and crime: The COVID-19 case

# The present study

# Methodology

## Data

Data recorded and published by the Police Service of Northern Ireland between April 2015 and May 2021 in the crime open data portal (<https://www.psni.police.uk/inside-psni/Statistics/police-recorded-crime-statistics/>). Historical crime data can also be downloaded from the online portal of Open Data Northern Ireland (<https://www.opendatani.gov.uk/dataset/police-recorded-crime-in-northern-ireland>).

## Analytical approach

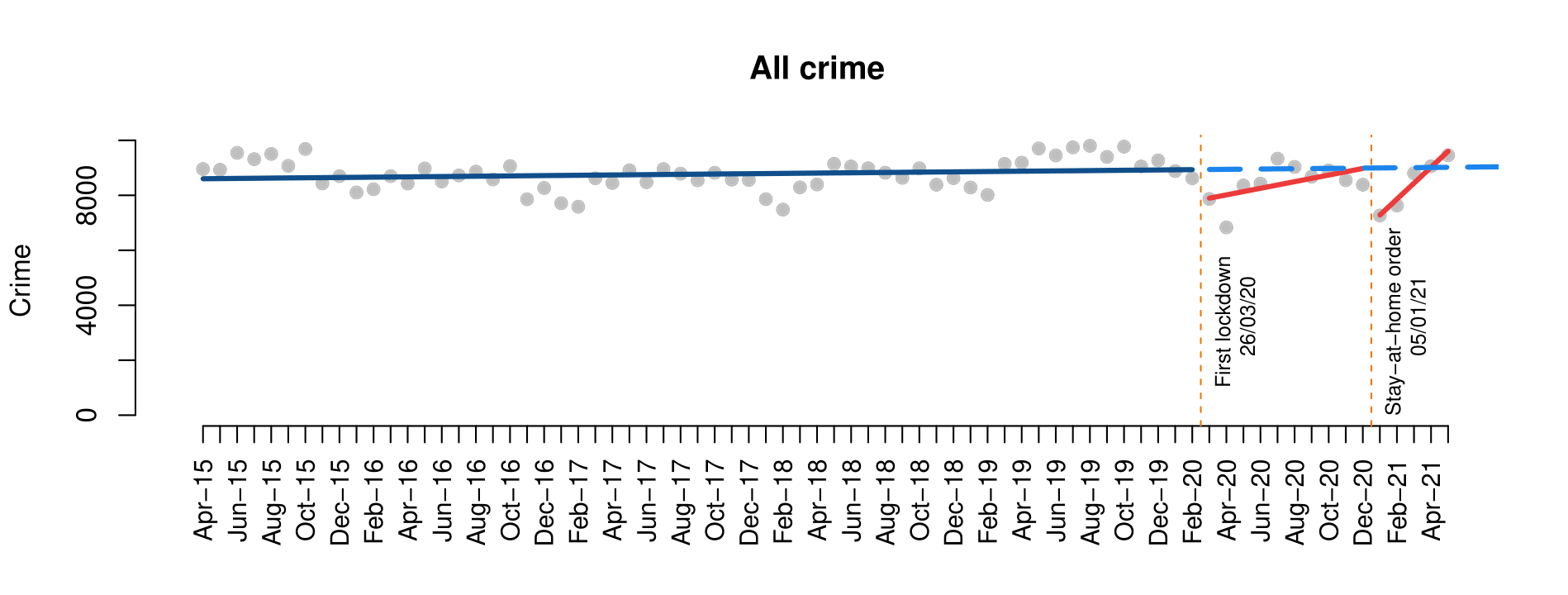
Interrupted time series analysis and counterfactuals

represents time in months, and the first and second lockdowns, respectively, and and the number of months since the first and second lockdowns, respectively.

Counterfactual predicted from

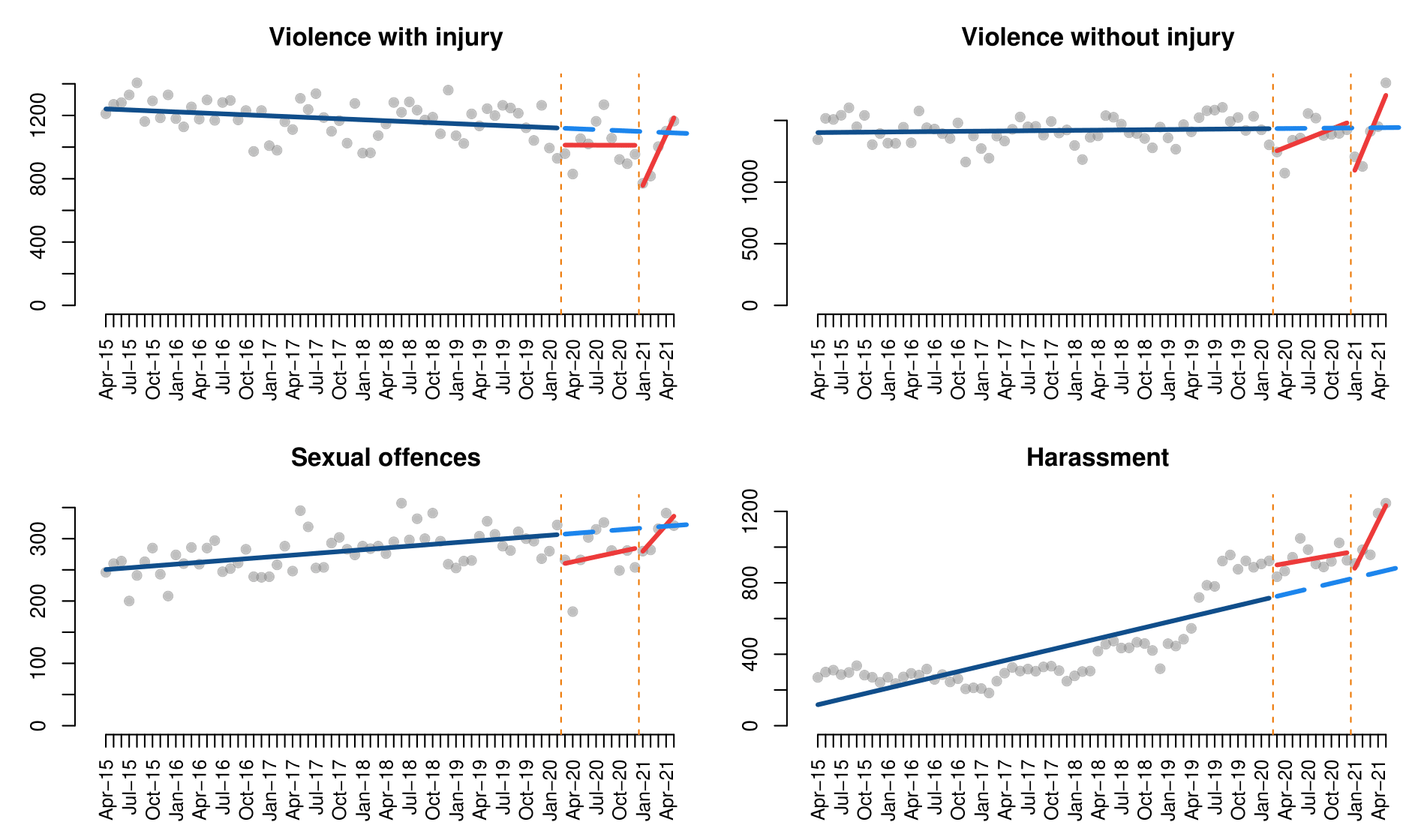
The analysis has been conducted in R software (R Core Team, 2021), and all data and codes are available from a Github repository ().

# Results



***Figure 1.*** *Interrupted time series analysis of all crime*

## Violent and sexual crime



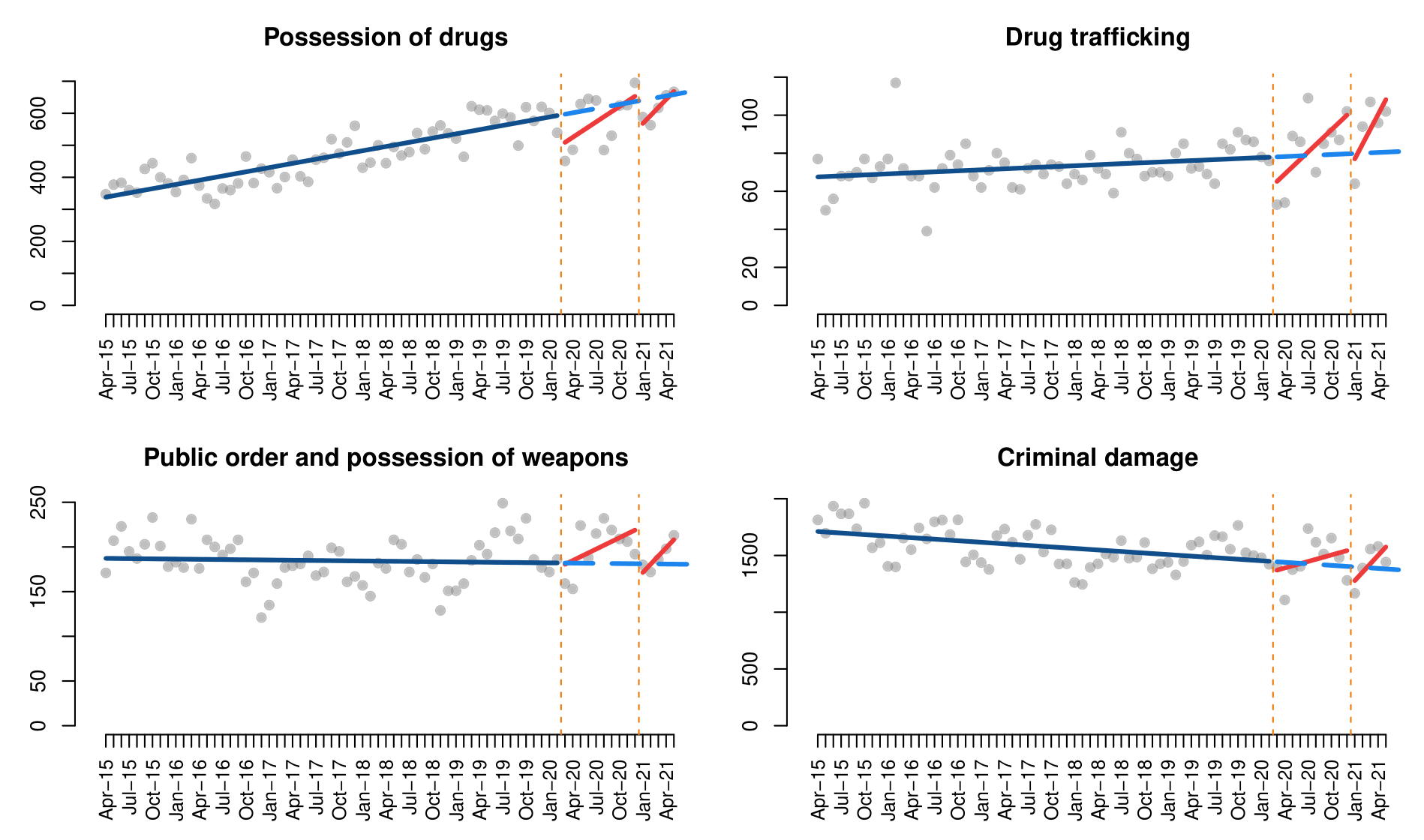
***Figure 2.*** *Interrupted time series analysis of violent and sexual crimes*

***Table 1.*** *Interrupted time series models of violent and sexual crimes*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Violence with injury | Violence without injury | Sexual offences | Harassment |
| (Intercept) | 1243.3\*\*\* | 1401.2\*\*\* | 249.5\*\*\* | 107.0\*\* |
| Time | -2.1\* | 0.5 | 1.0\*\*\* | 10.3\*\*\* |
| First lockdown | -108.1 | -204.5\* | -48.8\* | 178.0+ |
| Time since first lockdown | 1.9 | 24.6\* | 1.7 | -2.7 |
| Second lockdown | -450.0\*\*\* | -496.3\*\*\* | -50.4 | -24.2 |
| Time since second lockdown | 109.1\*\* | 151.8\*\*\* | 13.1 | 77.7+ |
| Adjusted R2 | 0.37 | 0.22 | 0.24 | 0.82 |

\*\*\*p-value<0.001, \*\*p-value<0.01, \*p-value<0.05, +p-value<0.1

## Drug crimes, damage and public order



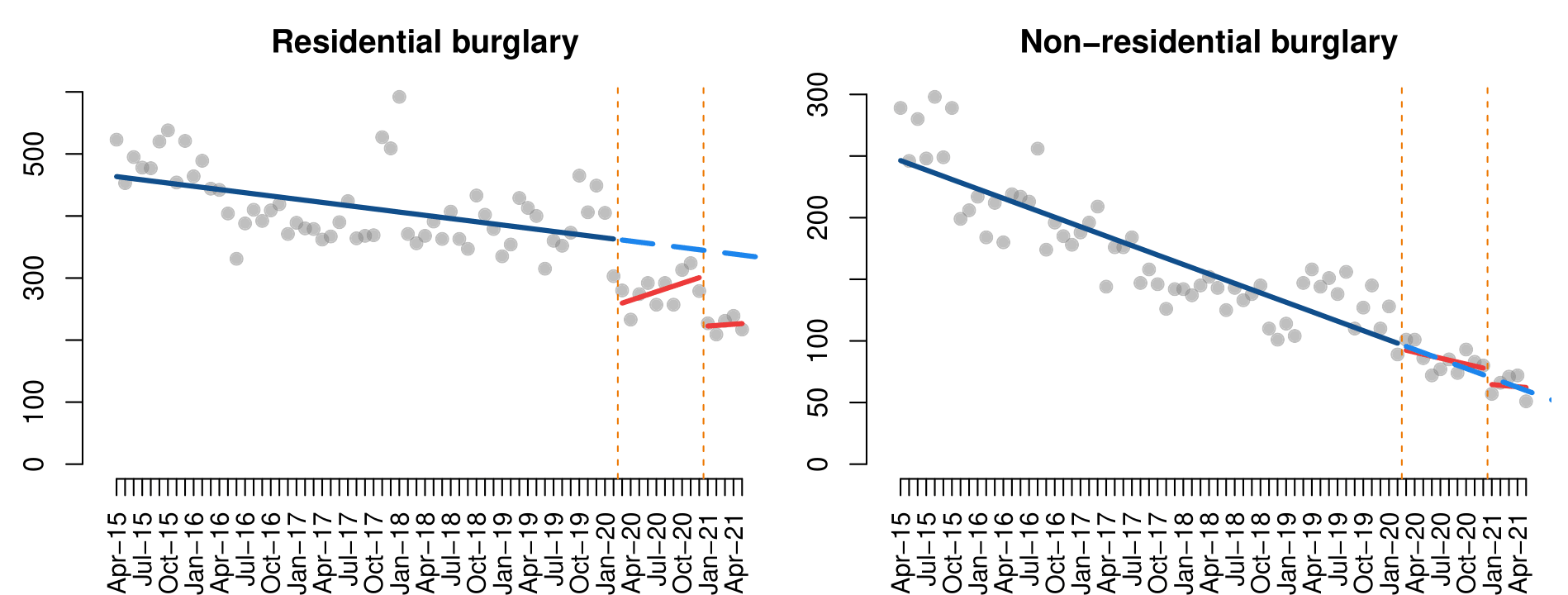
***Figure 3.*** *Interrupted time series analysis of drug crimes, damage and public order*

***Table 2.*** *Interrupted time series models of drug crimes, damage and public order*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Possession of drugs | Drug trafficking | Public order and possession of weapons | Criminal damage |
| (Intercept) | 333.8\*\*\* | 67.4\*\*\* | 187.3\*\*\* | 1716.0\*\*\* |
| Time | 4.4\*\*\* | 0.2\* | -0.1 | -4.5\*\*\* |
| First lockdown | -99.8\*\* | -16.6\* | -5.8 | -97.5 |
| Time since first lockdown | 11.6\* | 3.7\*\* | 4.3 | 23.6 |
| Second lockdown | -93.7+ | -10.5 | -19.0 | -200.1 |
| Time since second lockdown | 20.7 | 7.6\* | 9.3 | 78.8 |
| Adjusted R2 | 0.76 | 0.30 | 0.02 | 0.23 |

\*\*\*p-value<0.001, \*\*p-value<0.01, \*p-value<0.05, +p-value<0.1

## Burglary



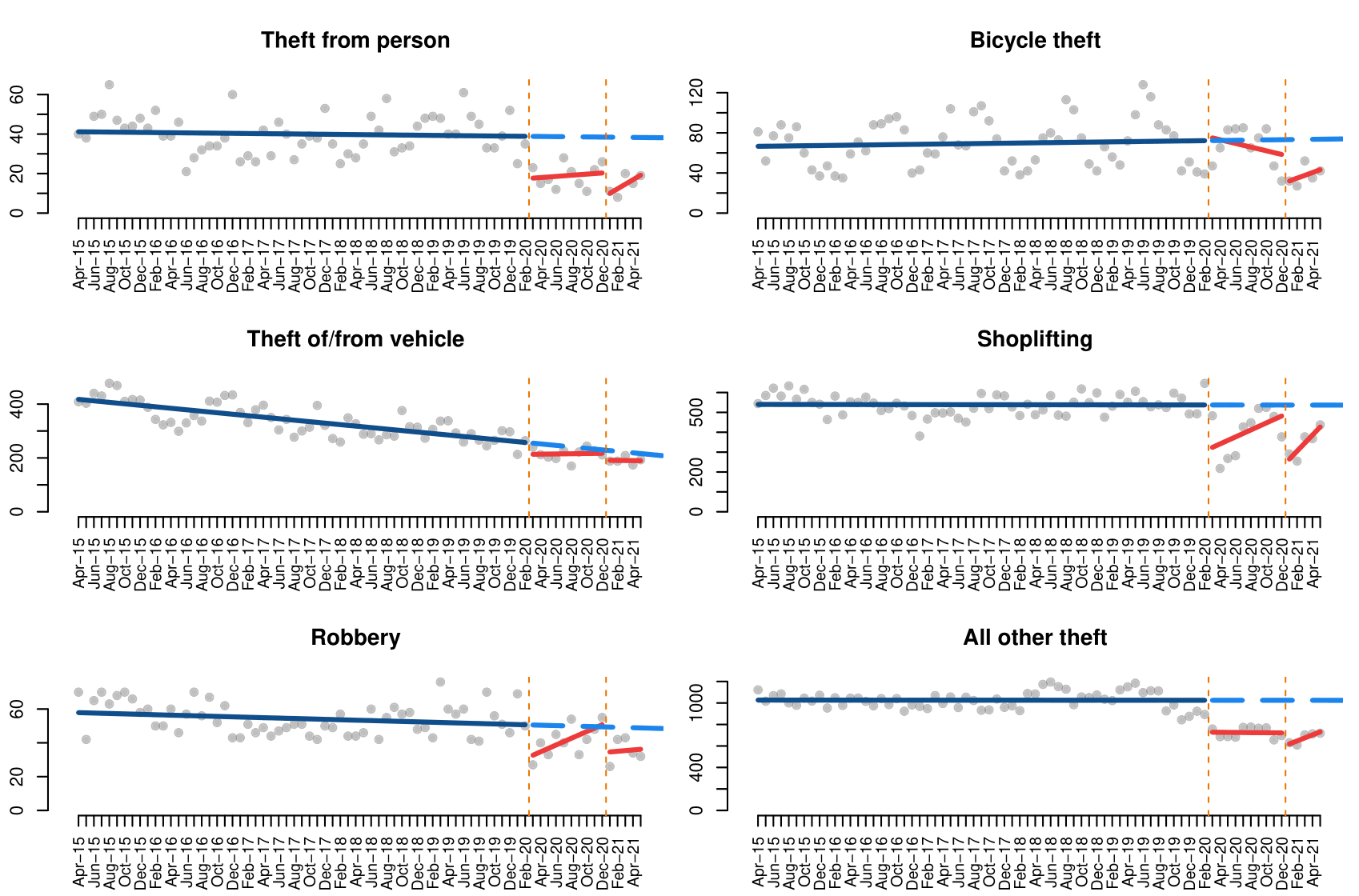
***Figure 4.*** *Interrupted time series analysis of burglary*

***Table 3.*** *Interrupted time series models of burglary*

|  |  |  |
| --- | --- | --- |
|  | Residential burglary | Non-residential burglary |
| (Intercept) | 465.2\*\*\* | 248.9\*\*\* |
| Time | -1.7\*\*\* | -2.6\*\*\* |
| First lockdown | -108.0\*\* | -4.1 |
| Time since first lockdown | 6.3 | 0.9 |
| Second lockdown | -124.1\* | -7.4 |
| Time since second lockdown | 2.7 | 2.0 |
| Adjusted R2 | 0.63 | 0.83 |

\*\*\*p-value<0.001, \*\*p-value<0.01, \*p-value<0.05, +p-value<0.1

## Theft and robbery



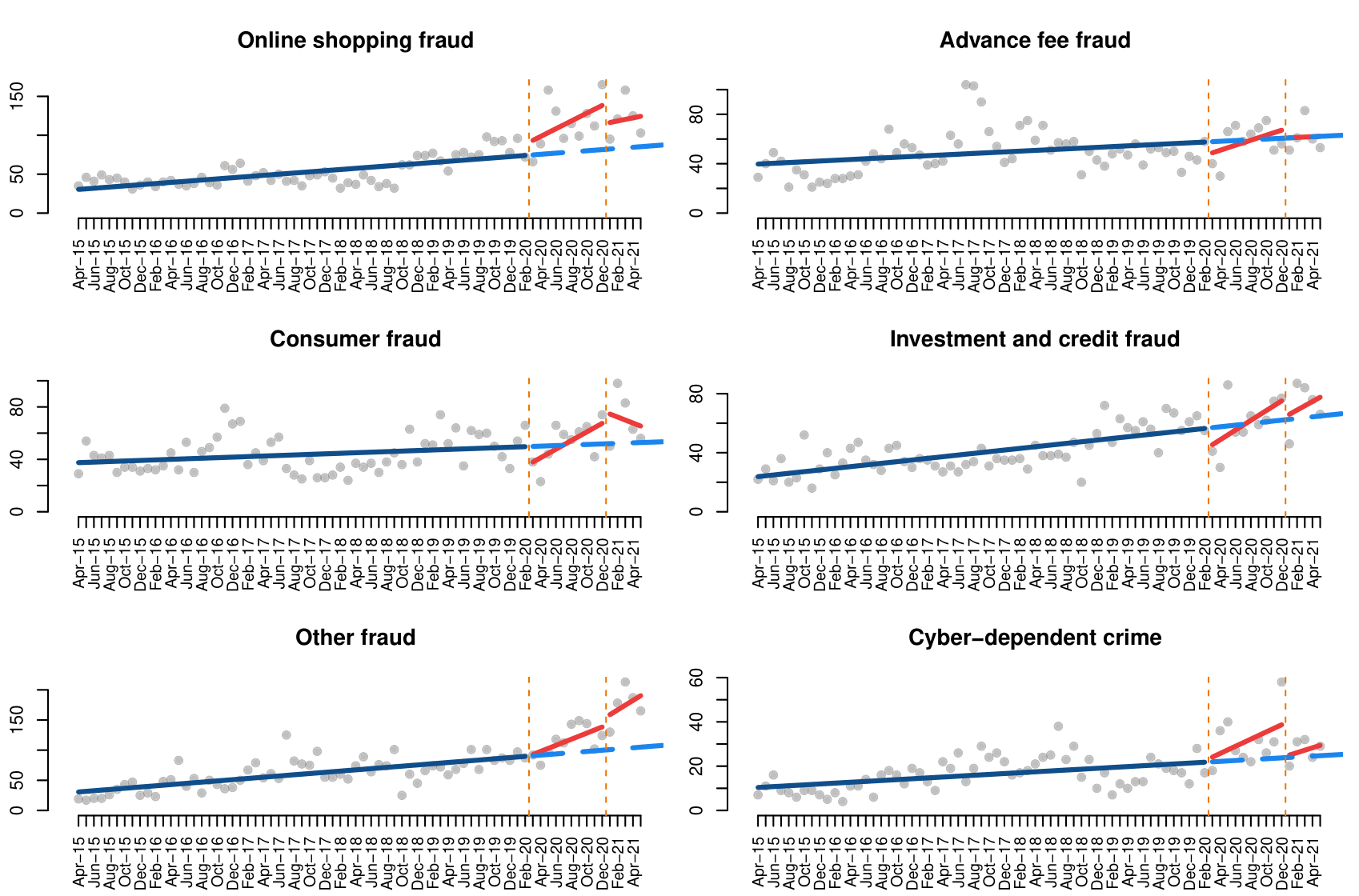
***Figure 5.*** *Interrupted time series analysis of theft and robbery*

***Table 4.*** *Interrupted time series models of theft and robbery*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Theft from person | Bicycle theft | Theft of/from vehicle | Shoplifting | Robbery | All other theft |
| (Intercept) | 41.2\*\*\* | 66.5\*\*\* | 420.3\*\*\* | 540.0\*\*\* | 58.0\*\*\* | 1026.8\*\*\* |
| Time | -0.0 | 0.1 | -2.8\*\*\* | -0.0 | -0.1+ | -0.0 |
| First lockdown | -21.5\*\* | 4.6 | -44.4 | -231.1\*\*\* | -20.0\*\* | -297.0\*\*\* |
| Time since first lockdown | 0.3 | -1.9 | 3.2 | 17.6\*\* | 2.1\* | -0.6 |
| Second lockdown | -30.8\*\* | -44.0+ | -38.3 | -312.7\*\*\* | -15.3 | -434.7\*\*\* |
| Time since second lockdown | 2.3 | 2.7 | 2.4 | 40.5\* | 0.5 | 28.2 |
| Adjusted R2 | 0.47 | 0.06 | 0.76 | 0.54 | 0.33 | 0.74 |

\*\*\*p-value<0.001, \*\*p-value<0.01, \*p-value<0.05, +p-value<0.1

## Fraud and cybercrime



***Figure 6.*** *Interrupted time series analysis of fraud and cybercrime*

***Table 5.*** *Interrupted time series model of fraud and cybercrime*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Online shopping fraud | Advance fee fraud | Consumer fraud | Investment and credit fraud | Other fraud | Cyber-dependent crime |
| (Intercept) | 29.7\*\*\* | 39.4\*\*\* | 37.3\*\*\* | 23.2\*\*\* | 29.6\*\*\* | 10.2\*\*\* |
| Time | 0.8\*\*\* | 0.3\* | 0.2\* | 0.6\*\*\* | 1.0\*\*\* | 0.2\*\*\* |
| First lockdown | 14.4 | -10.7 | -15.1 | -14.3+ | -1.9 | 0.7 |
| Time since first lockdown | 4.2\* | 1.7 | 3.1\* | 2.7\* | 4.0+ | 1.4+ |
| Second lockdown | 32.8+ | 0.1 | 25.1 | 1.0 | 51.0\* | 0.2 |
| Time since second lockdown | 1.2 | -0.0 | -2.5 | 2.3 | 6.9 | 0.9 |
| Adjusted R2 | 0.76 | 0.09 | 0.24 | 0.60 | 0.78 | 0.45 |

\*\*\*p-value<0.001, \*\*p-value<0.01, \*p-value<0.05, +p-value<0.1

# Discussion and conclusions

# References

R Core Team (2020). *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing. https://www.R-project.org/.