



Impact of night-time curfews during the Covid-19 pandemic on crash occurrences

^{1*} Straßgütl, Leon, ² Hirte, Georg

* lead presenter

¹ strassguetl@bast.de, Federal Highway Research Institute (BASt), Germany

² TU Dresden, Chair of Economics, especially Transport Policy and Spatial Economics,
Germany

Introduction

In the first winter during the Covid-19 pandemic, some states and counties in Germany introduced night-time curfews to curb the infection rate. The curfews were mandatory for all individuals with only a few exceptions. Particularly, work-related travel was still allowed as well as travel in cases of emergencies. Violations of the law resulted in fines that were county- or state-specific. In Baden-Württemberg, for example, the fine was 50-500 € (CoronaVO, 2020), but could potentially be as high as 25.000 € (IfSG, 2000).

In our study, we analyse the impact of this measure on crash counts and on the share of crash parameters. The objective is to establish, first, if there was a reduction in crash counts. Our main research question is if the structure of crashes changed due to the curfews. Thus, we analyse if the share of crash parameters changed or if the reduction was homogeneous for all parameters. We also examine if there were changes in the amount and structure of crashes in the hours shortly before and after the curfew.

Research Methodology

As data we use disaggregated crash data based on the police reports of the crash scene. Additionally, we use socioeconomic data on the county level as well as weather and exposure data on motorways.

We exploit the regional heterogeneity in night-time curfews to implement a quasi-natural experiment. Specifically, we apply a combination of the matching approach and the synthetic control approach with multiple treated units and flexible start dates of the treatment (Abadie et al., 2010; Abadie & Gardeazabal, 2003; Abadie & L'Hour, 2021; Kellogg et al., 2021). In total, there were 401 counties in Germany, 234 of which implemented a night-time curfew during the second Covid-19 wave in the winter months of 2020/2021. Using data from the pre-treatment period, we first construct synthetic control groups for these 234 counties – thus, we create counterfactuals as weighted averages of the remaining 167 counties without curfew. We combine this approach with the matching approach, namely by preferring the nearest untreated neighbours as control units (Abadie & L'Hour, 2021; Kellogg et al., 2021).



Then, we analyse the treatment effect of the curfew on crash counts with particular emphasis on the changes in the shares of crash parameters. The start date of the treatment, i.e., the implementation of the curfew, is constructed as flexible because the start date varied depending on the county. We additionally analyse the effect in the hours shortly before and after the curfew was in force. As an indicator for (induced) exposure, we look into the changes in the characteristics of non-responsible road users. The idea behind this is that while road users who are mainly responsible for a crash are not randomly selected from the driver pool, the crash opponent can, to a certain extent, be interpreted as a random draw from the driver pool at the time of the crash (Carr, 1969; Thorpe, 1964). The results are compared to other available exposure data, for instance to data of counting stations on motorways.

Results

We see a substantial and significant reduction in crash counts due to the curfew. Regarding the crash structure, we expect to see only small changes for parameters associated with work-related travel, e.g., in the amount of lorry crashes. We expect to see a disproportional huge reduction in crash parameters associated with leisure activities, e.g., crashes with multiple opponents per vehicle or of individuals not in the working age. With regard to young adults, we also assume to see a larger than overall reduction because of their relatively low income which makes fines relatively more expensive for them than for older adults. Although we expect to see a larger reduction in parameters associated with leisure- than with work-related trips, we assume that the reduction in parameters associated with leisure-activities is unequally distributed. We expect smaller reductions in crashes of especially risk-prone individuals, e.g., drink-driving. This is equivalent to an increase in the share of alcohol-related crashes.

Regarding the hours before and after the curfew, we expect an increase in the number of crashes. Especially shortly before the curfew, we assume to see an increase in crashes associated with time pressure, e.g., rear-end crashes and crashes related to speeding.

Discussion and conclusion

Our study aims to analyse the effect of night-time curfews on crash counts and on the crash structure. We study if the crash counts decline more than the exposure for specific crash parameters. We further analyse the impact the curfew had during times in which the measure did not apply. The analysis contributes to understanding how changes in the composition of traffic changes crash occurrences.

References

Abadie, A., Diamond, A., & Hainmueller, J. (2010). Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program. *Journal of the American Statistical Association*, 105(490), 493–505. <https://doi.org/10.1198/jasa.2009.ap08746>



International Co-operation on Theories and
Concepts in Traffic Safety

- Abadie, A., & Gardeazabal, J. (2003). The Economic Costs of Conflict: A Case Study of the Basque Country. *American Economic Review*, 93(1), 113–132. <https://doi.org/10.1257/000282803321455188>
- Abadie, A., & L'Hour, J. (2021). A Penalized Synthetic Control Estimator for Disaggregated Data. *Journal of the American Statistical Association*, 116(536), 1817–1834.
- Carr, B. R. (1969). A statistical analysis of rural Ontario traffic accidents using induced exposure data. *Accident Analysis & Prevention*, 1(4), 343–357.
- CoronaVO. (2020). Bußgeldkatalog für Ordnungswidrigkeiten nach dem Infektionsschutzgesetz im Zusammenhang mit der CoronaVO in der Fassung vom 17.12.2020.
- IfSG. (2000). Gesetz zur Verhütung und Bekämpfung von Infektionskrankheiten beim Menschen (Infektionsschutzgesetz - IfSG). <https://www.gesetze-im-internet.de/ifsg/BJNR104510000.html>
- Kellogg, M., Mogstad, M., Pouliot, G. A., & Torgovitsky, A. (2021). Combining Matching and Synthetic Control to Trade off Biases from Extrapolation and Interpolation. *Journal of the American Statistical Association*, 116(536), 1804–1816.
- Thorpe, J. D. (1964). Calculating relative involvement rates in accidents without determining exposure. *Australian Road Research* 1964, 2(1), 25–36.