

Spatial and Temporal Assessment of Conflicts, Violence and Political Demonstrations: Case of Pakistan

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Extended abstract

Political violence is a complex and multifaceted phenomenon that can have profound consequences for individuals, communities, and entire nations. It is essential for policymakers, scholars, and citizens to comprehend the causes and effects of political violence. While the locations of conflicts and political violence are well known, a more comprehensive and thorough investigation into the spatio-temporal changes of conflicts remain an essential frontier in big data driven conflict studies. Availability of big data presents an opportunity to transformative understanding of these contemporary issues and their dynamics.

Increasing availability of spatial and temporal data requires a new tools for analysis. Already known methods of analysis for political violence, conflicts and demonstrations data (both spatial and spatio-temporal) include *regression¹ analysis* (Otsby et al., 2011, Basedau & Pierskalla, 2014; Verpoorten, 2012; Wallace et al., 2014, Khatiwada, 2014, Ide et al., 2014, Hsiang et al., 2011), *Monte Carlo Simulation* (Schutte & Weidmann, 2011) *spatial count modelling* (Dorward & Fox, 2022; Rafail, 2018; Tadesse, 2023), and finally, *point pattern analysis* (Frank & Witmer, 2008, Bastos et al., 2014; Walther et al., 2023) - interesting approach combining point pattern and areal spatial analyses). The existing literature on conflict studies have summarized the prevailing socioeconomic inequalities and climate change factors as the potential drivers of conflicts.

This study examines the political violence at the regional level in Pakistan from the time period 2010-2023 using the big data on conflicts provided by Armed Conflict Location & Event Data Project (ACLED). In particular, we use data on four different types of violence, which are battles, riots, explosions and violence against civilians. Due to some incorrect measurements (in a fatalities data) and duplicates (caused by providing information about several conflict sides), our study pattern consists of around 35000 of observations (varying from 1500 to 4000 point locations dependently on a year). We apply point pattern analysis techniques, specifically, spatial distribution of political violence to examine and visualize the phenomenon of political violence across various regions, intensity analysis to assess the severity of political violence and cross-dependence to investigate spatial coexistence between points of different types (battles, riots, explosions and violence against civilians). Choice of analysis instruments was easy because of availability of conflicts' locations – we believe that results obtained with use of disaggregated data at the regional level will be more interesting and useful.

Firstly, we discover inseparability of spatial and temporal dimensions – that means (1) we cannot analyse our data only from spatial perspective, and (2) this is a good possibility to investigate the dynamics of the process.

Secondly, our results exhibit strong spatial and temporal effects in four spatial typologies of political violence (battles, riots, explosions and violence against civilians). Spatial maps illustrate the spatial concentration and clustering of political violence in northern (KPK) and Western regions (Baluchistan) of Pakistan. Year on year analysis illustrates that the intensity and spread in political violence is

¹ Here, we include both spatial and a-spatial approaches for OLS, binary and multiple choice models, and exclude count modelling, which is more represented and in our opinion has to be mentioned separately

becoming more prominent in the country. Central and north eastern regions have emerged as the new spots for political violence in the recent years. Specifically, south and central Punjab along with northern region Gilgit Baltistan are the evolving areas. Furthermore, we found the spatial coexistence of riots, battles and remote violence in the northern and western region of Pakistan which are labelled as the hotspots for conflicts. Finally, 3d plot of spatio-temporal Ripley's K shows, that with increase of both spatial and temporal dimensions, the level of clustering in the analysed point pattern increases.

Obtained results will be useful from several perspectives with wide range of policy implications:

- By examining political violence from a localised and spatial perspective, researchers can gain insights into how the spatial configuration of countries influences all forms of violence. This can aid in identifying areas that are vulnerable to political violence and devising strategies to prevent it;
- They can help identify the underlying causes of violence and conflicts by examining how spatial and temporal factors contribute to the escalation and expansion of such events;
- They can help researchers gain a deeper understanding of the intricate relationships between space, time, and political violence, which can pave way for future research and informed policy decisions.

Further steps of analysis require additional data related to demographics, climate change, religious polarization, socioeconomic disparities such as population, deprivation, income inequality and migration etc. After collection of such data, we consider the following research procedures:

- 1) estimation of Geographically (and/or Temporally) Weighted Regression and comparison of its results with Spatial Poisson model – we believe that GWR/GTWR approach will produce better results than spatial count model. On the other hand, we think that exclusion of spatial count modelling approach would be inappropriate;
- 2) estimation of Gibbs process model – we believe, that there are interactions not only between different types of political violence, but also within each single type. Thus, such analysis seems to shed a light on a true nature of point pattern representing locations of political violence's.
- 3) Monte Carlo simulations and computational experiments simulating data sets using realistic geographies which is perfectly tailored for subsequent regression analysis and to account for methodological issues faced in spatial diffusion and spatial aggregation

Literature:

- Basedau, M., & Pierskalla, J. H. (2014). How ethnicity conditions the effect of oil and gas on civil conflict: A spatial analysis of Africa from 1990 to 2010. *Political Geography*, 38, 1–11. <https://doi.org/10.1016/j.polgeo.2013.10.001>
- Bastos, M. T., Recuero, R., & Zago, G. (2014). Taking tweets to the streets: A spatial analysis of the Vinegar Protests in Brazil. *First Monday*, 19(3), Article 3. <https://doi.org/10.5210/fm.v19i3.5227>
- Dorward, N., & Fox, S. (2022). Population pressure, political institutions, and protests: A multilevel analysis of protest events in African cities. *Political Geography*, 99, 102762. <https://doi.org/10.1016/j.polgeo.2022.102762>
- Hsiang, S. M., Meng, K. C., & Cane, M. A. (2011). Civil conflicts are associated with the global climate. *Nature*, 476(7361), 438-441. <https://doi.org/10.1038/nature10311>

- Ide, T., Schilling, J., Link, J. S., Scheffran, J., Ngaruiya, G., & Weinzierl, T. (2014). On exposure, vulnerability and violence: spatial distribution of risk factors for climate change and violent conflict across Kenya and Uganda. *Political Geography*, 43, 68-81. <https://doi.org/10.1016/j.polgeo.2014.10.007>
- Khatiwada, L. K. (2014). A spatial approach in locating and explaining conflict hot spots in Nepal. *Eurasian Geography and Economics*, 55(2), 201-217. <https://doi.org/10.1080/15387216.2014.956135>
- Østby, G., Urdal, H., Tadjeddin, M. Z., Murshed, S. M., & Strand, H. (2011). Population pressure, horizontal inequality and political violence: A disaggregated study of Indonesian provinces, 1990–2003. *The Journal of Development Studies*, 47(3), 377-398. <http://doi.org/10.1080/00220388.2010.506911>
- O'Loughlin, J., & Witmer, F. D. (2011). The localized geographies of violence in the North Caucasus of Russia, 1999–2007. *Annals of the Association of American Geographers*, 101(1), 178-201. <https://doi.org/10.1080/00045608.2010.534713>
- Rafail, P. (2018). Protest in the city: Urban spatial restructuring and dissent in New York, 1960–2006. *Urban Studies*, 55(1), 244–260. <https://doi.org/10.1177/0042098016661464>
- Schutte, S., & Weidmann, N. B. (2011). Diffusion patterns of violence in civil wars. *Political Geography*, 30(3), 143-152. <https://doi.org/10.1016/j.polgeo.2011.03.005>
- Tadesse, H. (2023). Modelling Conflict Dynamics: Evidence from Africa: What Do the Data Show via Spatiotemporal Global ACLED Dataset? *Applied Spatial Analysis and Policy*, 16(4), 1541–1559. <https://doi.org/10.1007/s12061-023-09522-1>.
- Verpoorten, M. (2012). Detecting hidden violence: The spatial distribution of excess mortality in Rwanda. *Political Geography*, 31(1), 44–56. <https://doi.org/10.1016/j.polgeo.2011.09.004>
- Wallace, S. J., Zepeda-Millán, C., & Jones-Correa, M. (2014). Spatial and Temporal Proximity: Examining the Effects of Protests on Political Attitudes. *American Journal of Political Science*, 58(2), 433–448. <https://doi.org/10.1111/ajps.12060>
- Walther, O. J., Radil, S. M., Russell, D. G., & Trémolières, M. (2023). Introducing the Spatial Conflict Dynamics Indicator of Political Violence. *Terrorism and Political Violence*, 35(3), 533–552. <https://doi.org/10.1080/09546553.2021.1957846>