Brief analysis of Night-Time lights of Russian Federation measured from satellite

Nicolò Badino[1]

[1]*PhD candidate - University of Genova*

June 21, 2024

1. Introduction and Analysis

This brief analysis shows that since the invasion of Ukraine, Russia's nighttime lights (NTL), as measured by satellite, have shown unexpected increases[1]. The data sources include NASA's Black Marble project for NTL, GADM for borders, OpenStreetMap for cities and towns, and EOG Data Mines for gas flare mapping. The findings indicate a significant increase in Russia's NTL starting from the year of Ukraine's invasion, contrasting sharply with other European countries.

Past literature, such as Henderson et al. (2012) and Chen and Nordhaus (2011), have shown a strong correlation between NTL and GDP, suggesting that NTL can serve as a proxy for economic activity. The exceptional increase in Russia's NTL during the conflict is surprising. This phenomenon might be attributed to autarchy and the war economy.

NTL values for Russia are aggregated, using 2021 as the baseline year (indexed to 100). Figures from figure 1 display the NTL measurements for Russian regions from 2018 to 2023, showing significant increases in all the regions with a focus on urban and non-urban areas. Masking for gas flare sites doesn't change the results much. It is evident that the main driver of regional night-time lights increase after the war are non-urban areas

[1]Code soon available at https://github.com/nbadino/Russia-NTL

For further work, the next step may be computing the distance to military sites. This would allow for investigating whether there is a correlation between the distance to military bases and the percentage growth of NTL. Further analysis should investigate potential sources of NTL anomalies in non-urban areas.

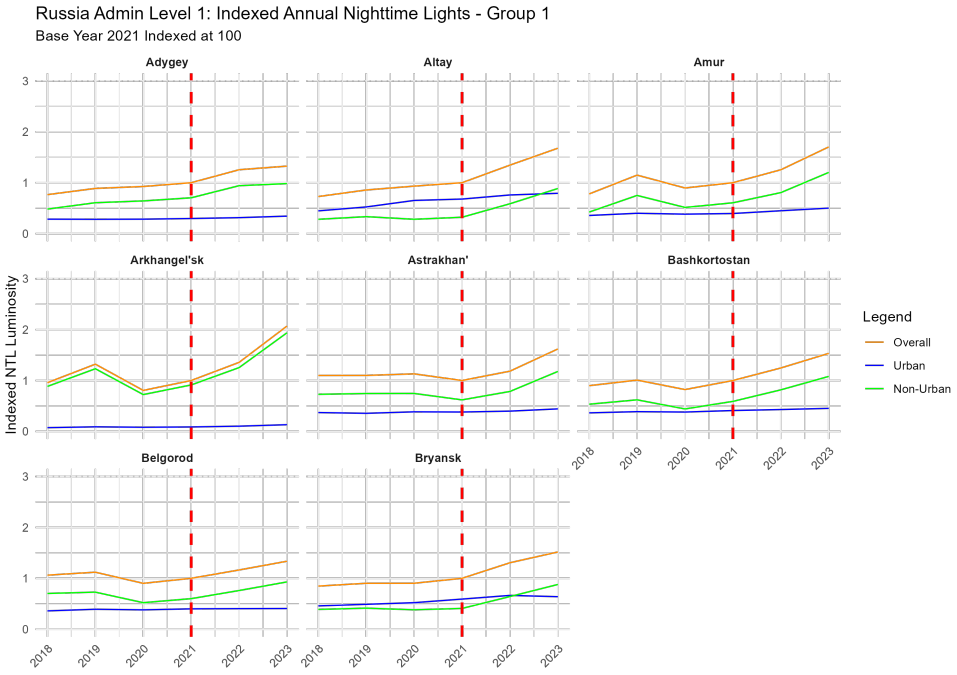

FIGURE 1. Group 1

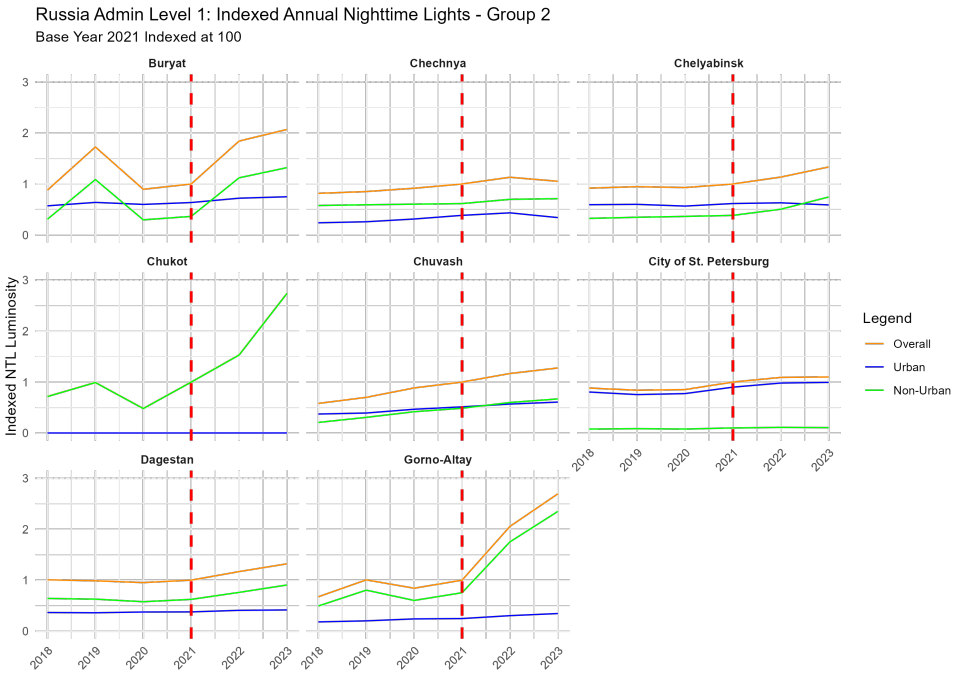

FIGURE 2. Group 2

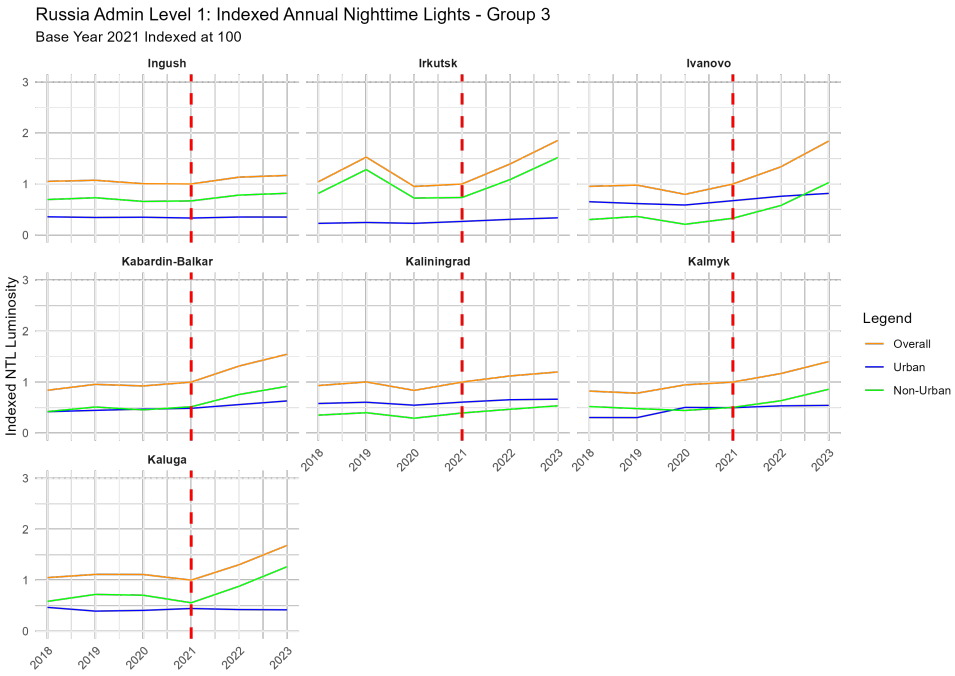

FIGURE 3. Group 3

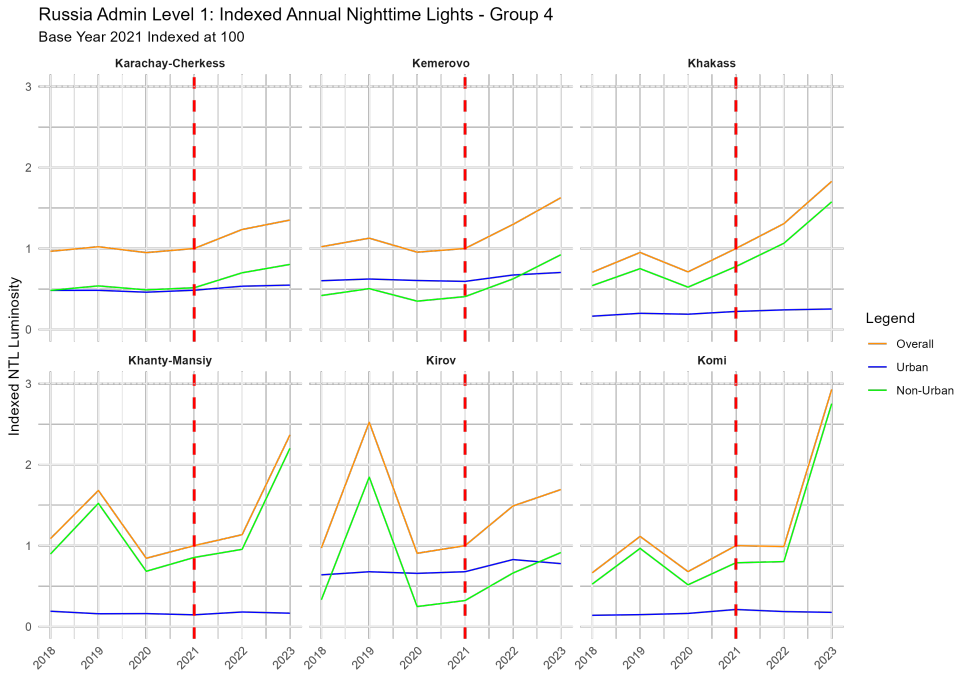

FIGURE 4. Group 4

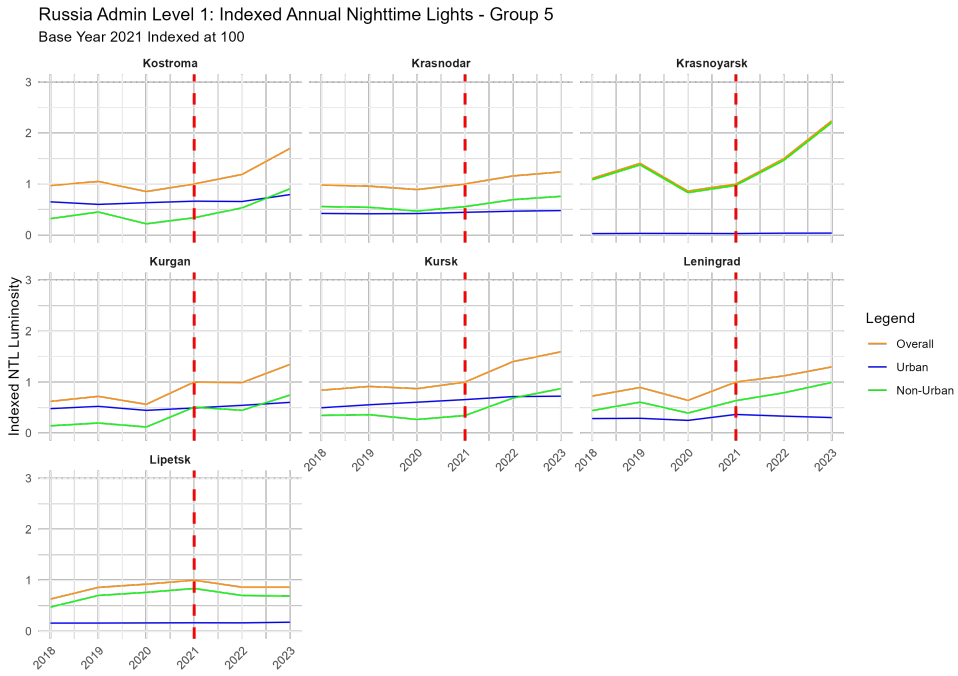

FIGURE 5. Group 5

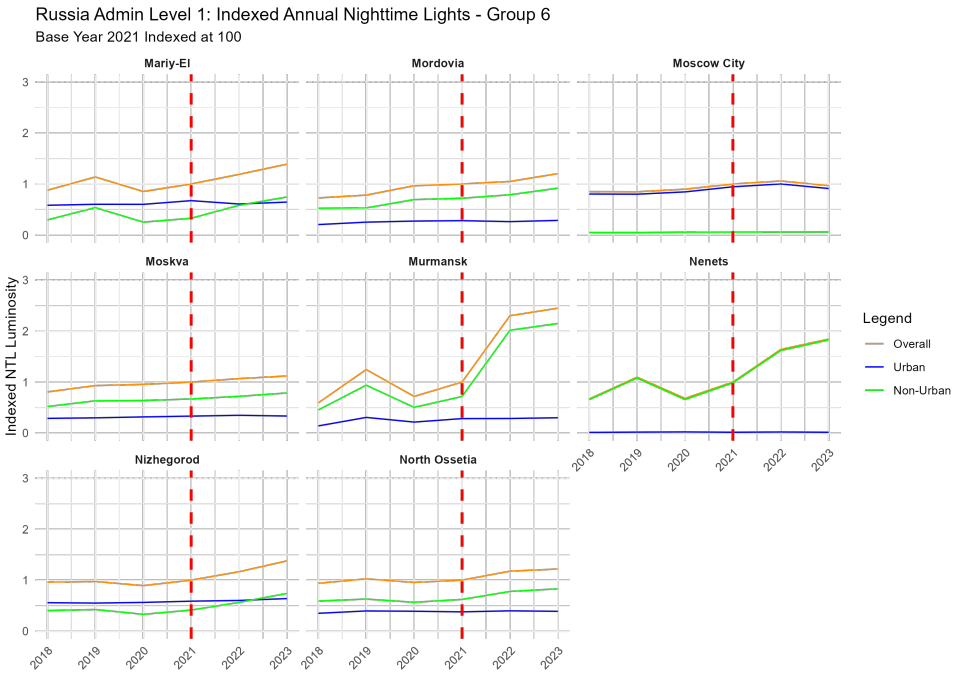

FIGURE 6. Group 6

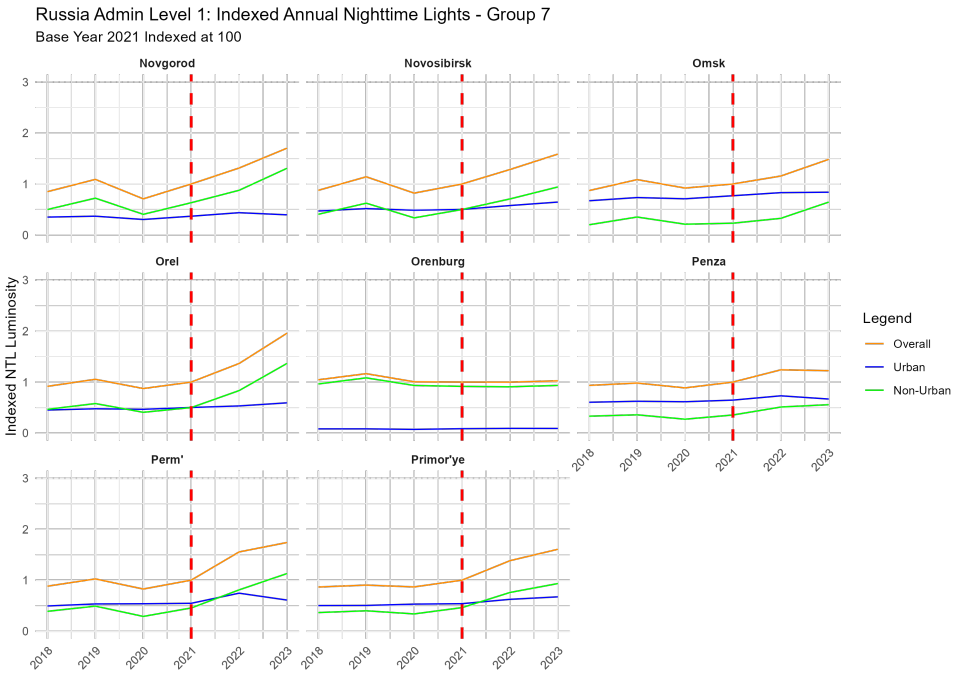

FIGURE 7. Group 7

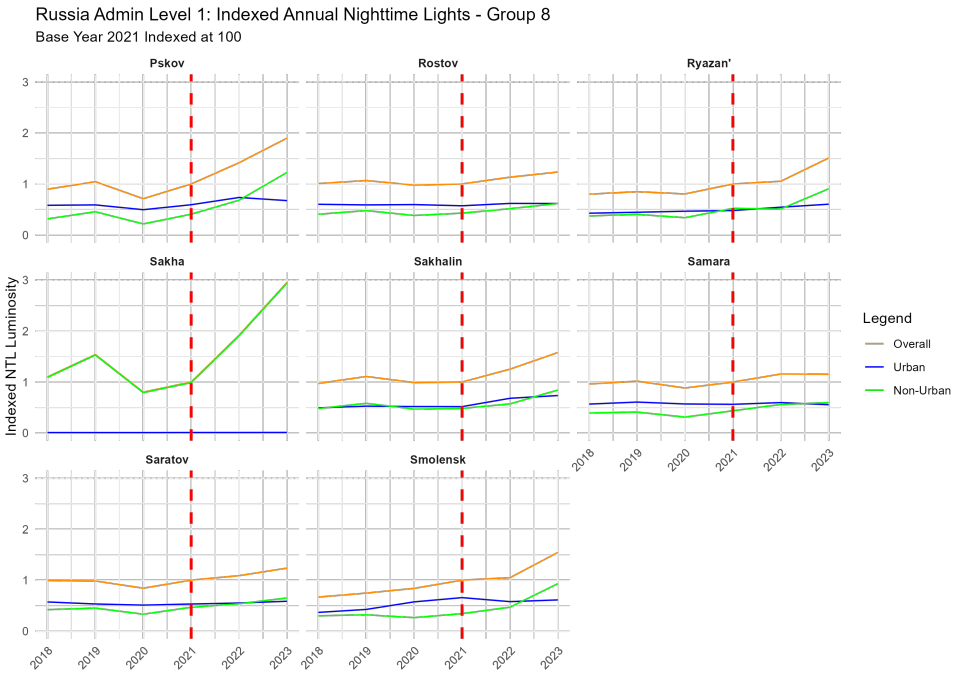

FIGURE 8. Group 8

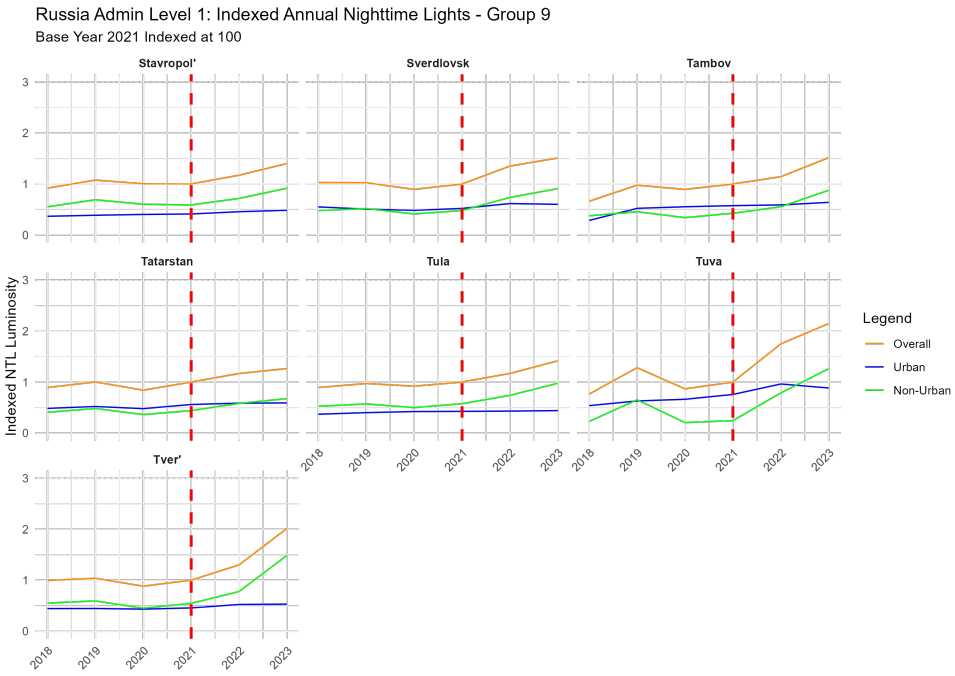

FIGURE 9. Group 9

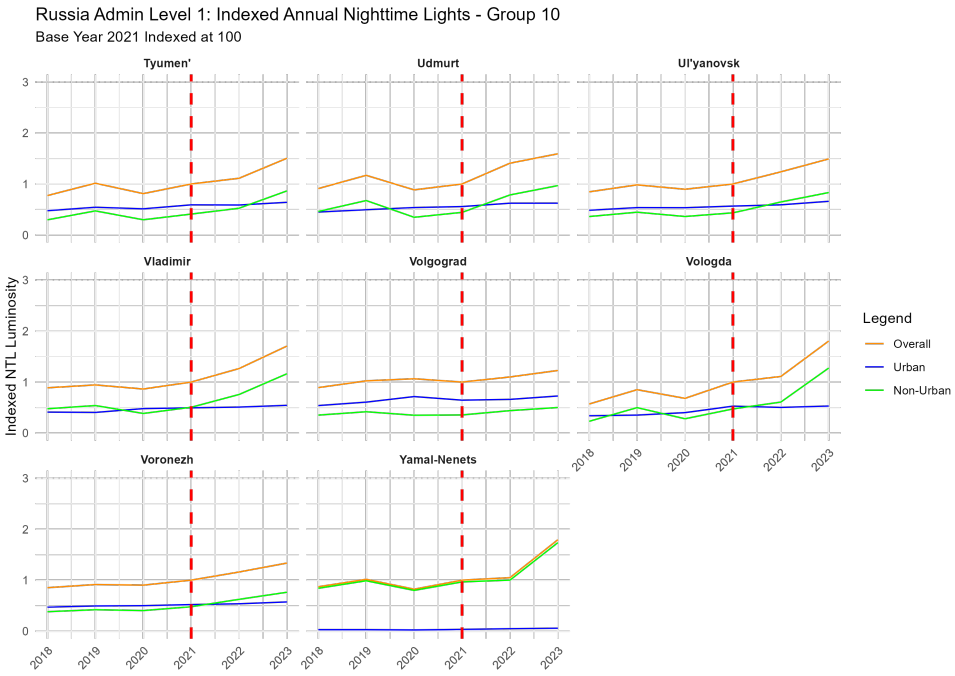

FIGURE 10. Group 10

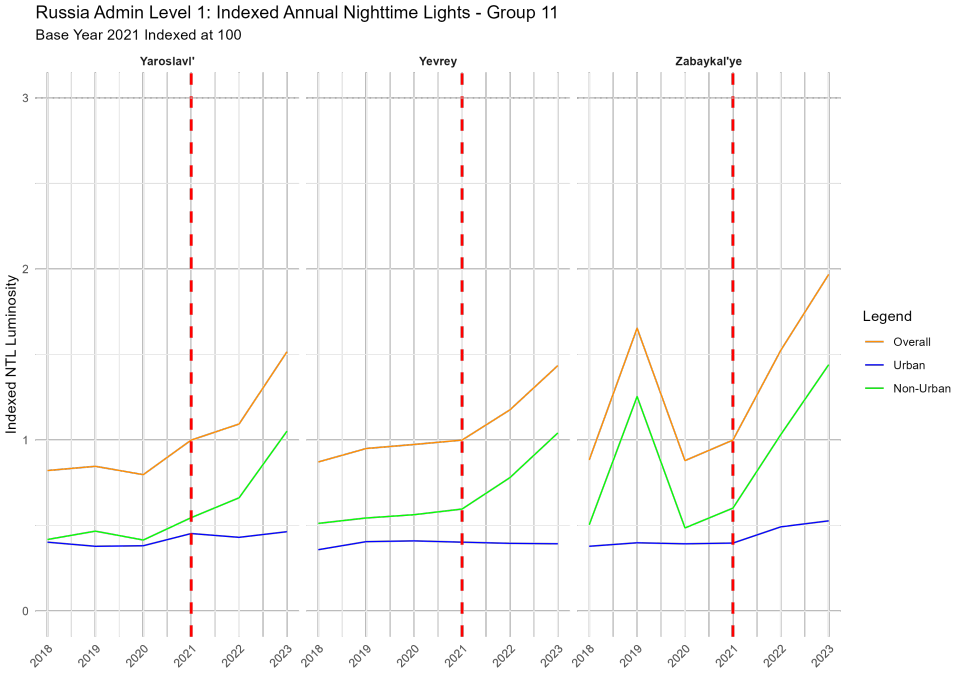

FIGURE 11. Group 11

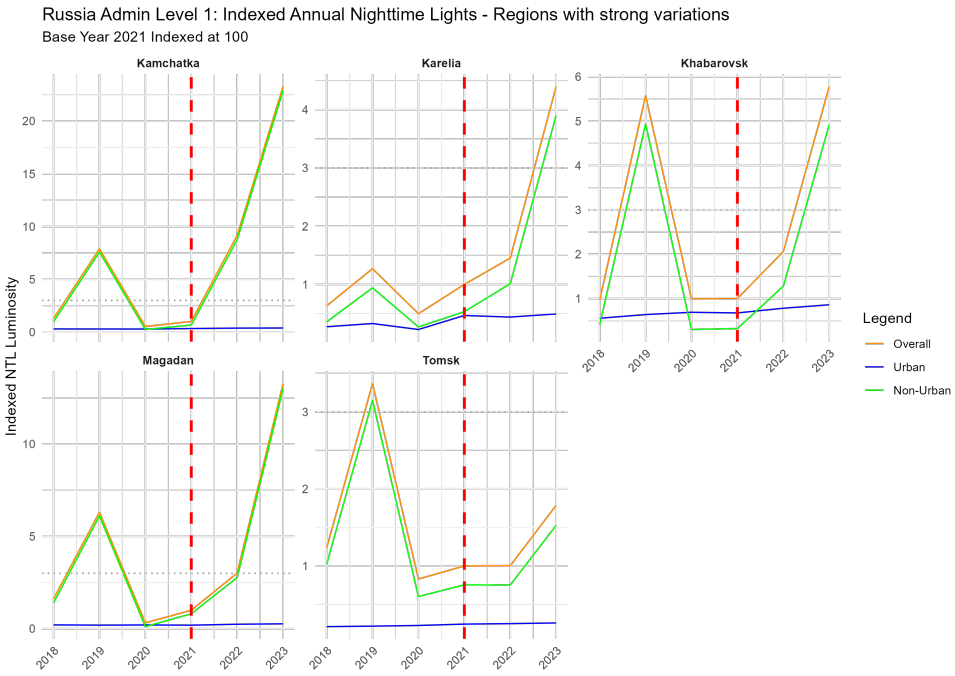

FIGURE 12. Regions with extreme variations

References

Chen, X. and Nordhaus, W. D. (2011). Using luminosity data as a proxy for economic statistics. *Proceedings of the National Academy of Sciences*, 108(21):8589–8594.

Henderson, J. V., Storeygard, A., and Weil, D. N. (2012). Measuring economic growth from outer space. *American economic review*, 102(2):994–1028.