MSc Thesis: Statistical Properties of the Moving Epidemic Method to Classify the Severity of Influenza Seasons

supervised by Prof. Dr. Melanie Schienle and Johannes Bracher (ECON, Ökonometrie und Statistik)

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Public health agencies like the European Center for Disease Control (ECDC) or the US Centers for Disease Control and Prevention (CDC) have an interest in classification systems to determine the beginning and end of influenza seasons and their severity during peak weeks. A commonly used method to derive the required thresholds (e.g. for *low, medium, high* and *very high* peak influenza activity) is the so-called *moving epidemic method* (MEM, Vega et al 2012). Applications to European countries and the US can be found in Vega et al (2015) and Biggerstaff et al (2017), respectively. An implementation is provided in the `R` package `mem`.

While this method has been found to yield reasonable results in numerous applied epidemiological studies, its statistical poperties do not seem to have been studied in detail. In particular, there are some open questions on how the method behaves in situations where only few years of training data are available. The proposed MSc thesis aims to provide such an assessment. Using simulation studies, real data studies and potentially analytical arguments we will aim to analyse properties of the Moving Epidemic Method, some yet to define variations of it and potentially existing alternative methods. Possible steps include (but are not limited to):

- Literature review on applications of MEM and alternative methods.
- Analysis of `R` code from the `mem` package to make the exact procedure explicit.
- Identification and analysis of suitable real data sets.
- Design and implementation of simulation studies, including bootstrapping approaches based on real data.
- Comparison of results to selected alternative procedures like the WHO method (WHO 2017 and references therein; may require re-implementation in `R`).
- Suggestion of variations of the MEM method or an alternative procedure in order to improve behaviour in situations with limited training data.

This topic is right for you if you have

- very good prior knowledge of applied statistics.
- an interest in data analyses and simulation studies with public health implications.
- advanced knowledge of the programming language `R`.
- experience with or are willing to learn reproducible workflows, in particular using version control (`git`/`gitlab`).

Prior knowledge in epidemiology is an advantage, but not required. The thesis will be jointly supervised by Prof. Melanie Schienle and Johannes Bracher. If you are interested please send an email containing a list of past coursework during your MSc studies (incl. grades), the name and average grade of your BSc/BA degree, and a brief statement of motivation ($\leq$ 100 words) to: Johannes Bracher, `johannes.bracher@partner.kit.edu`.

References

M Biggerstaff, K Kniss, DB Jernigan, L Brammer, J Bresee, S Garg, E Burns, and C Reed (2017): Systematic Assessment of Multiple Routine and Near Real-Time Indicators to Classify the Severity of Influenza Seasons and Pandemics in the United States, 2003–2004 Through 2015–2016. American Journal of Epidemiology 187(5): 1040–1050.

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