

A STUDY OF SEASONAL PATTERNS OF BIRTH FOR VELKE POLE, SLOVAKIA BETWEEN 1781 AND 1900

Introduction and Motivation

This thesis analyzes the birth seasonality patterns in Velke Pole for the period between 1781 and 1900, broken down into periods of 10 years. Following the mantra “correlation is not causation”, a deeper understanding of the role of climatological factors, namely temperature and precipitation, on birth seasonality patterns is attempted.

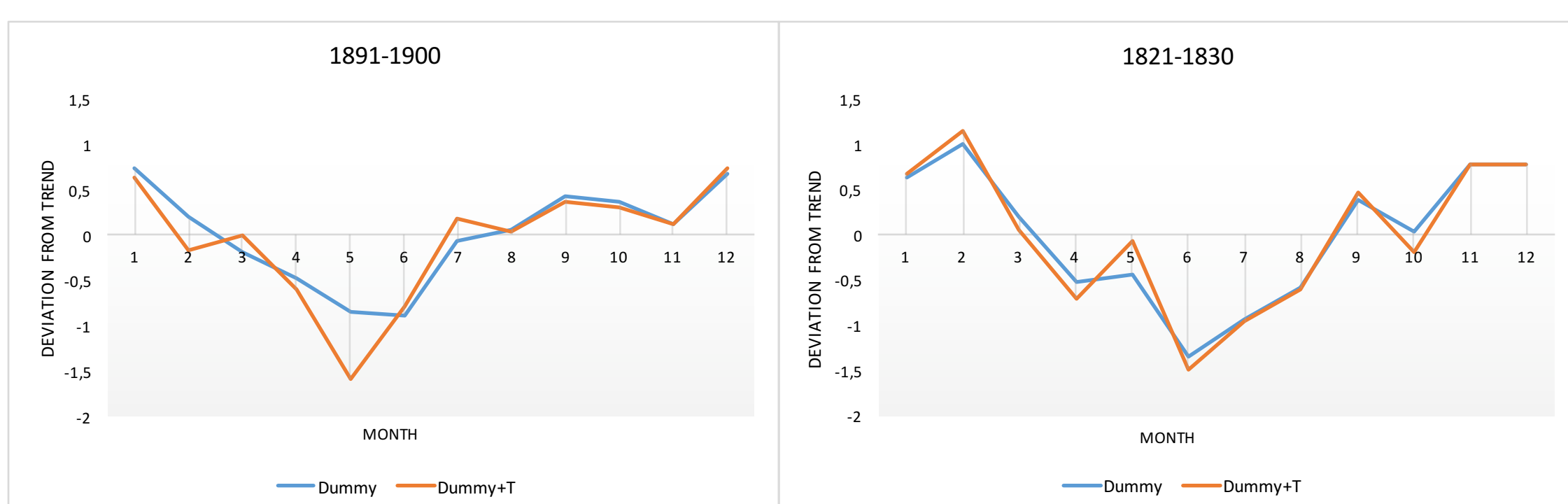
To achieve these goals, certain statistical methods were developed and some borrowed from scholars researching this topic for many years .

There were extensive researches done by social scientists for entire countries, like U.S.A, former West Germany, Italy, and so on, but the eastern European region still remains largely unexplored, one of the reasons for this may be the political turmoil that persisted till modern times which rendered country-wide studies infeasible.

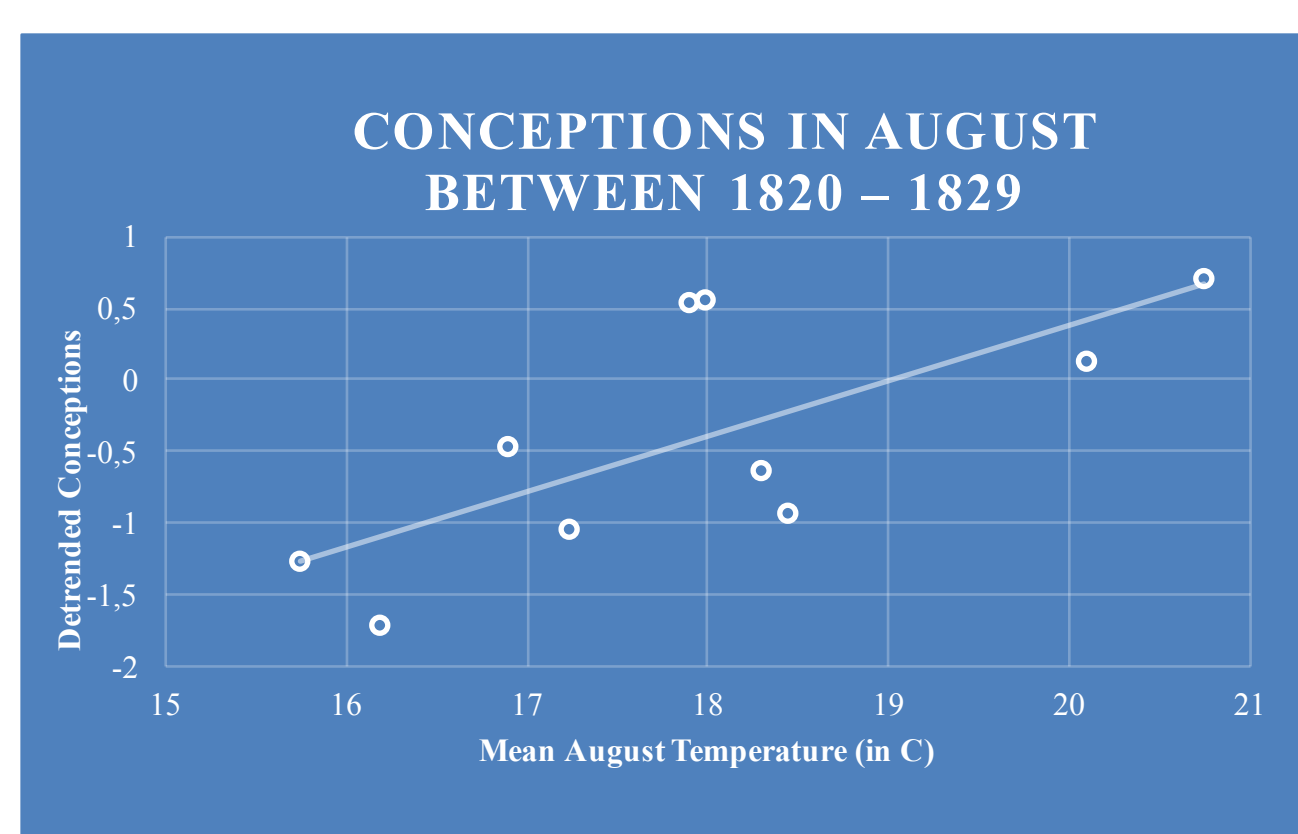
A combination of factors from socio-economic to climatological as well as political and technological – introduction of air-conditioning to laws protecting working mothers, all found to have influences on birth seasonality patterns.

Contribution

- This work attempts to document and expose more about the life and times in a part of Europe that is not very widely discussed and not well documented in the English language.
- A record of temperature and precipitation for Velke Pole has now been created using from 1780 -1900, which can be used for estimations and other research purposes, or to interpolate data for other locations nearby.
- The data transform functions implemented in Python could be used as templates for processing a wide array of data sets owing to their similarity in data formats and processing requirements.



Predicted logged birth deviation from trend regressed against Dummy (blue) and Dummy with temperature controls (orange)



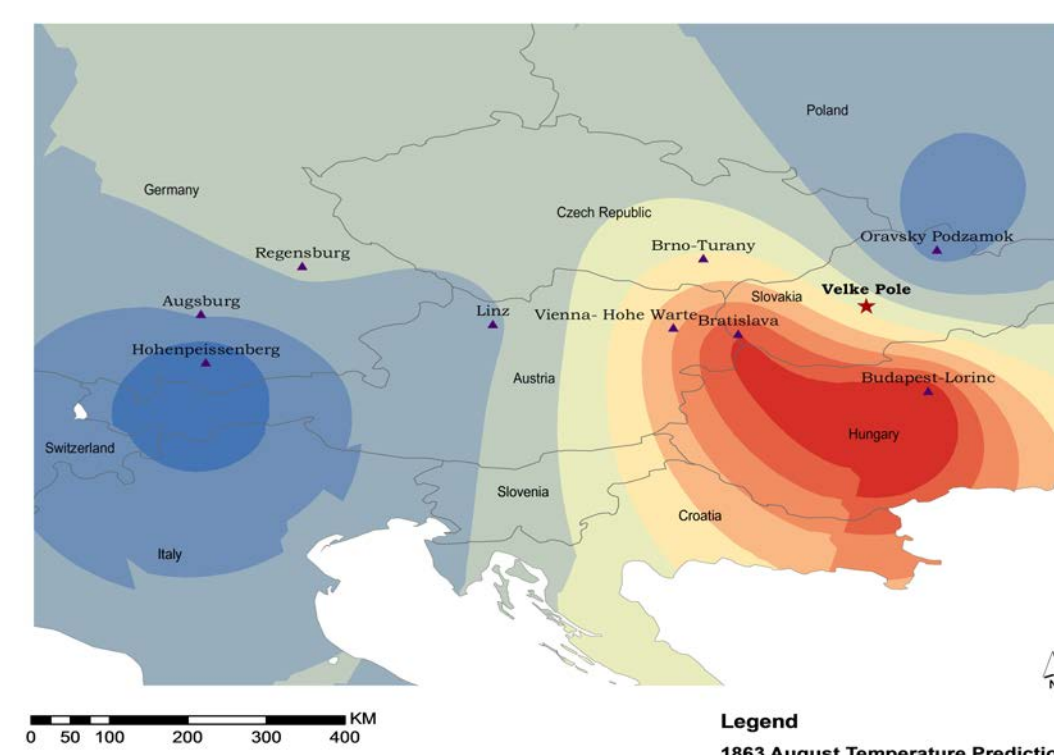
Nonseasonal Temperature variation and Conception

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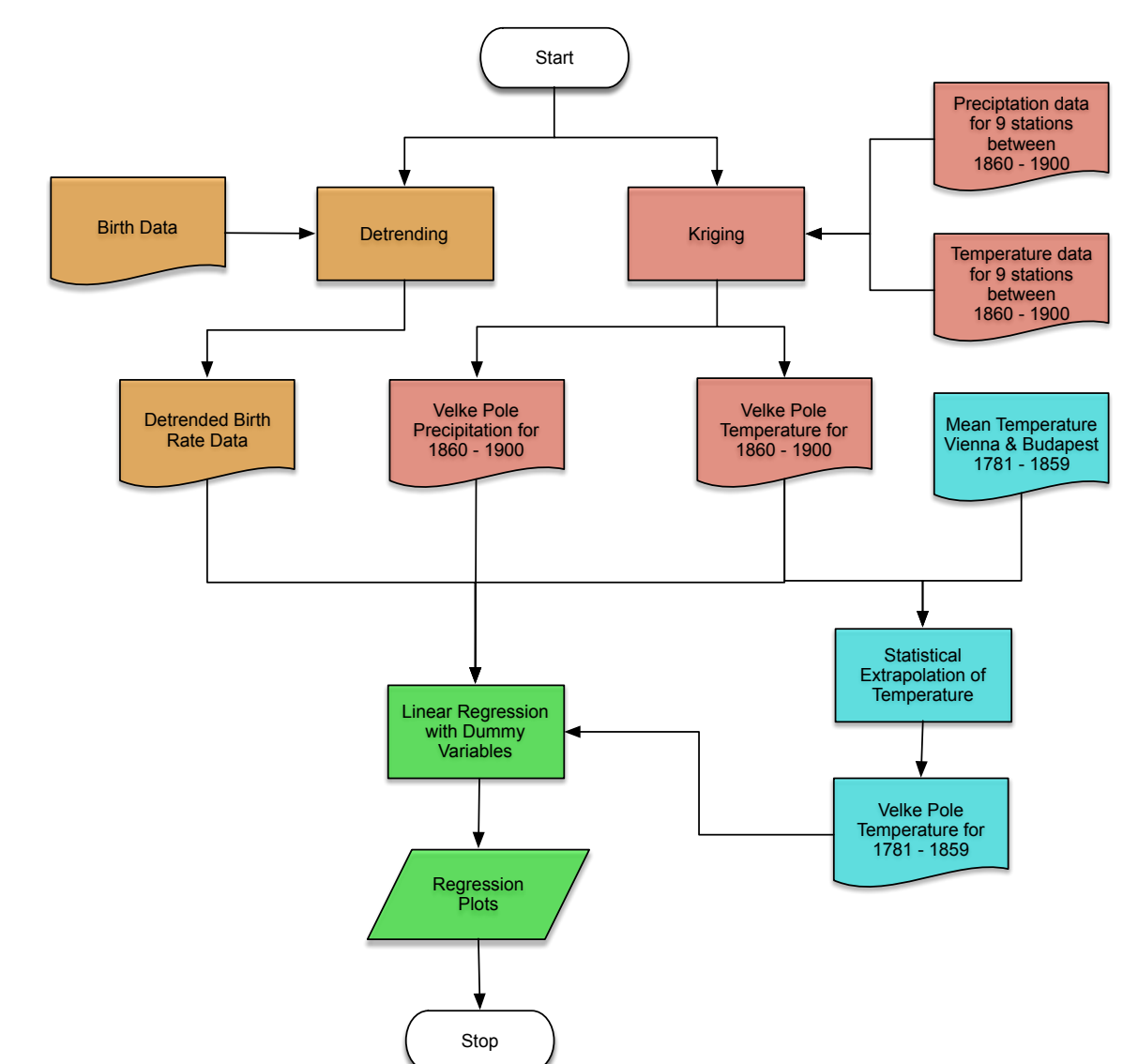
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Methodology

- Orange: The statistical concept of moving averages has been applied to normalise the available monthly birth data in order to remove unwarranted seasonal trends.
- Red: A set of geospatial interpolation techniques, namely Kriging, employed to determine the temperature and rainfall of Velke Pole from adjoining areas.
- Cyan: Processes are developed to perform statistical extrapolation techniques based on results obtained from Kriging and temperature data from previous periods with the goal of determining missing monthly temperature values for the period under study.
- Green: Finally, regression analysis has been done on the detrended values of birth rates and the extrapolated temperature data in order to find relationship between dependent and independent variables.



Temperature prediction map through Ordinary Kriging.



Methodology Flowchart

$$\ln b_t = \sum_{s=1}^{12} \alpha_s d_t^s + \beta_1 T_{t-9} + \beta_2 T_{t-9}^2 + \beta_3 P_{t-9} + \beta_4 P_{t-9}^2$$

Tools

- Python libraries Pandas and NumPy have been used for data cleaning and munging.
- ArcGIS 10.3 has been used to spatially interpolate temperature and precipitation data for Velke Pole through Ordinary Kriging under Geostatistical Analyst.
- MS Excel Data Analysis Toolpak is used for doing Multiple Regression and drawing the charts.

Conclusion

- Results show that precipitation was not a significant enough determinant of birth seasonality but, temperature might have had a larger role to play as an influencer, but it still cannot be held completely responsible for the seasonal pattern.
- For most months, conception has a positive correlation with temperature as seen in the nonseasonal temperature variation plot, unlike in some other countries, mostly because climate is continental with mild temperature fluctuations in Slovakia.
- Comparison with other countries (for post-war periods) show that Velke Pole has a unique seasonality pattern that does not match completely with any of the other researched countries.
- The spring – summer troughs in birth could be attributed to harvesting and autumnal planting that resulted in the work force (men) being away from homes.