Application of Implicitly Weighted Regression Quantiles: Analysis of the 2018 Czech Presidential Election

Jan Kalina and Petra Vidnerová

ÚI AV ČR

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Outline

- Introduction
- Weighted regression quantiles
- Results
- Conclusion

Introduction

Regression quantiles

- popular tool for a complex modeling
- implicitly weighted regression quantiles
- illustrate their usefullness
- first application of the implicitly weighted regression quantiles to data with more than one regressors

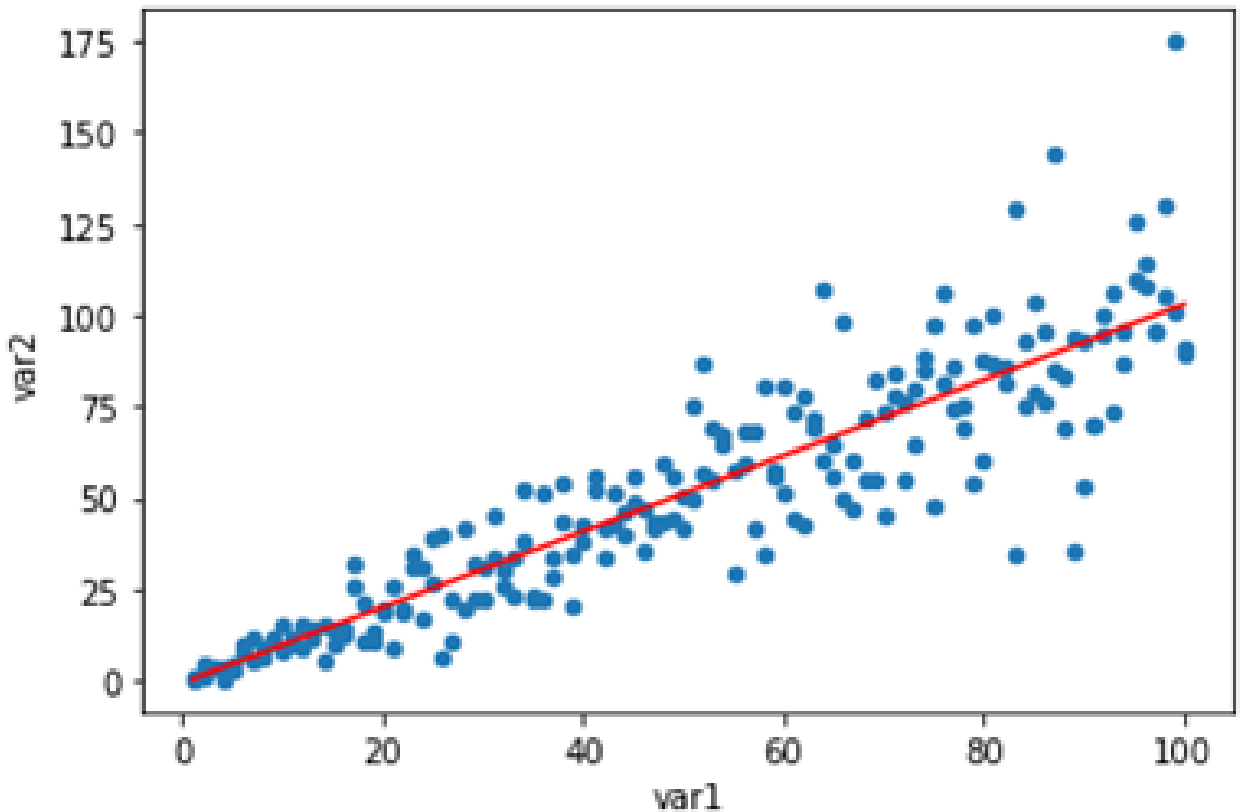
Dataset

- second round of the presidental election in 2018 (Miloš Zeman, Jiří Drahoš)
- as a regression problem
- 4 regressors, one output variable
- 77 Czech counties as 77 meassurements

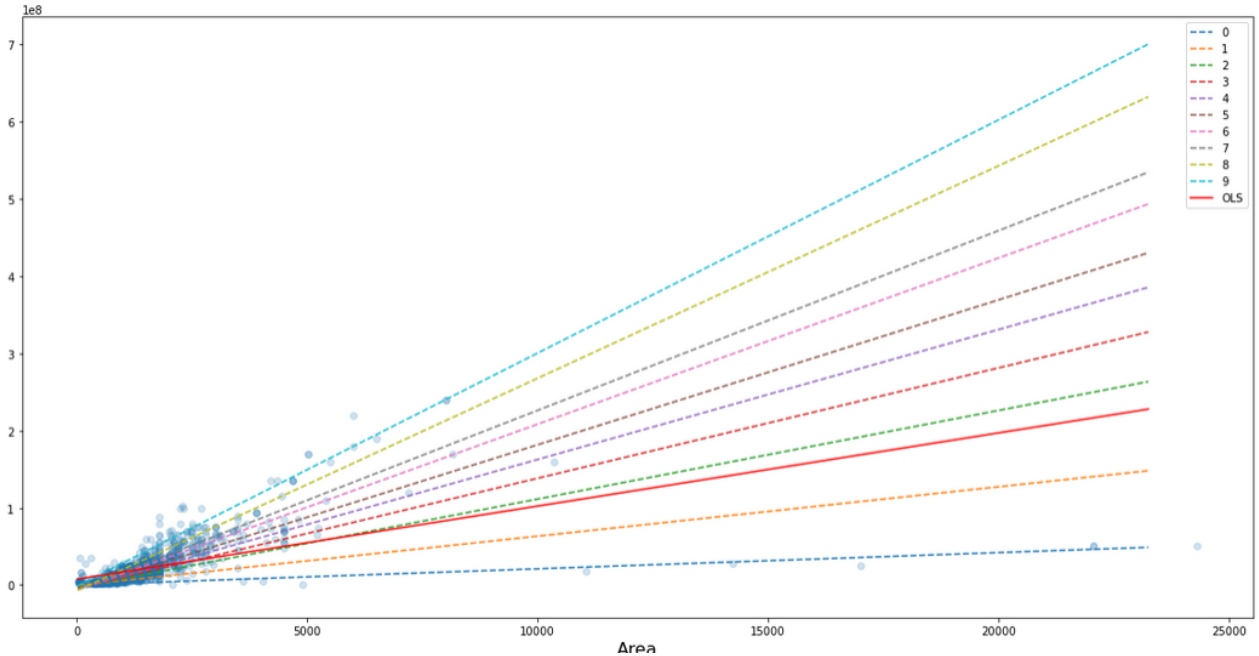
Regression

Standard linear regression

- $Y_i = \beta_0 + \beta_1 X_{i1} + \ldots + \beta_p X_{ip} + e_i, i = 1, \ldots, n$
- Y_i continuous response variable
- $X_{i1}, \ldots, X_{ip}$ regressors, features
- β_i regression parameters



Regression quantiles



- quantile regression provides more information
- especially useful for heteroscedastic data

Implicitely weighted regression quantiles

Motivation

- standard regression quantiles not robust
- standard regression quantiles influenced by leverage points

Solution

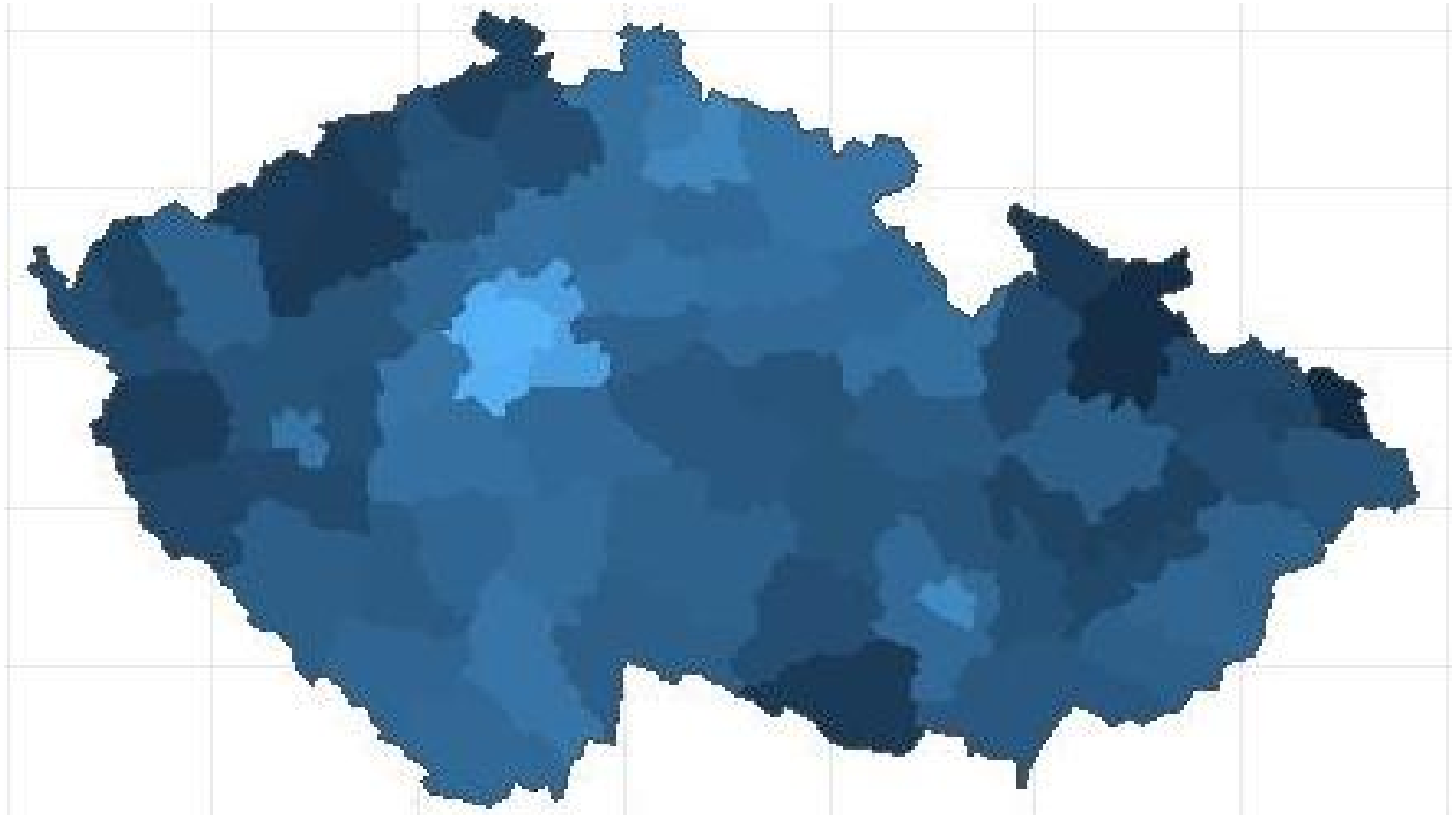
- we introduce weights to individual data points
- points are weighted according residuals
- trimmed linearly decreasing weights

Dataset

- second round of presidental election in 2018 (Zeman, Drahoš)
- data samples per 77 Czech counties

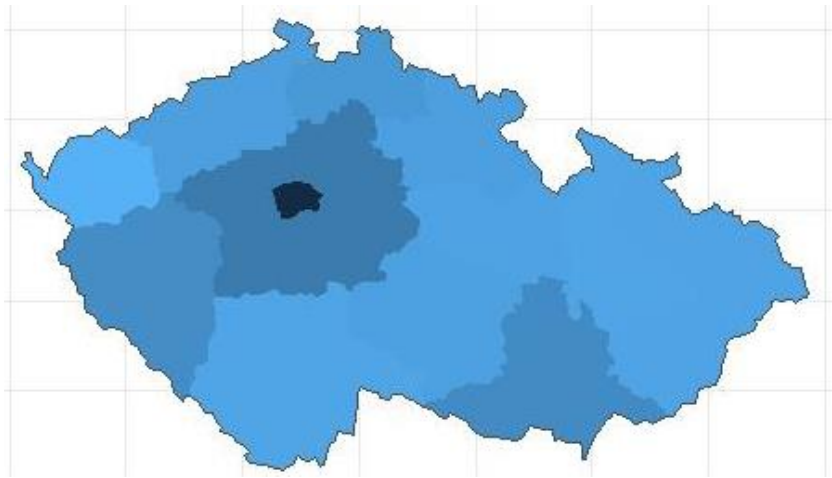
- **response** results of Miloš Zeman (percentage)
- 4 **predictors**
  - average wage (in the fourth quater of 2018)
  - logarithm of the population density
  - percentage of believers
  - percentage of people in execution

Mapy - response Y

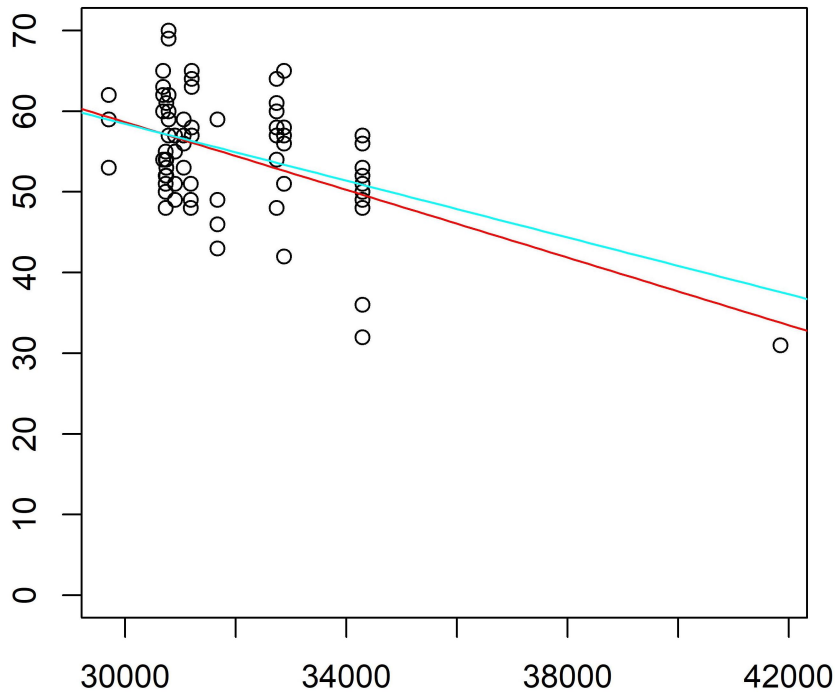


Results (X1)

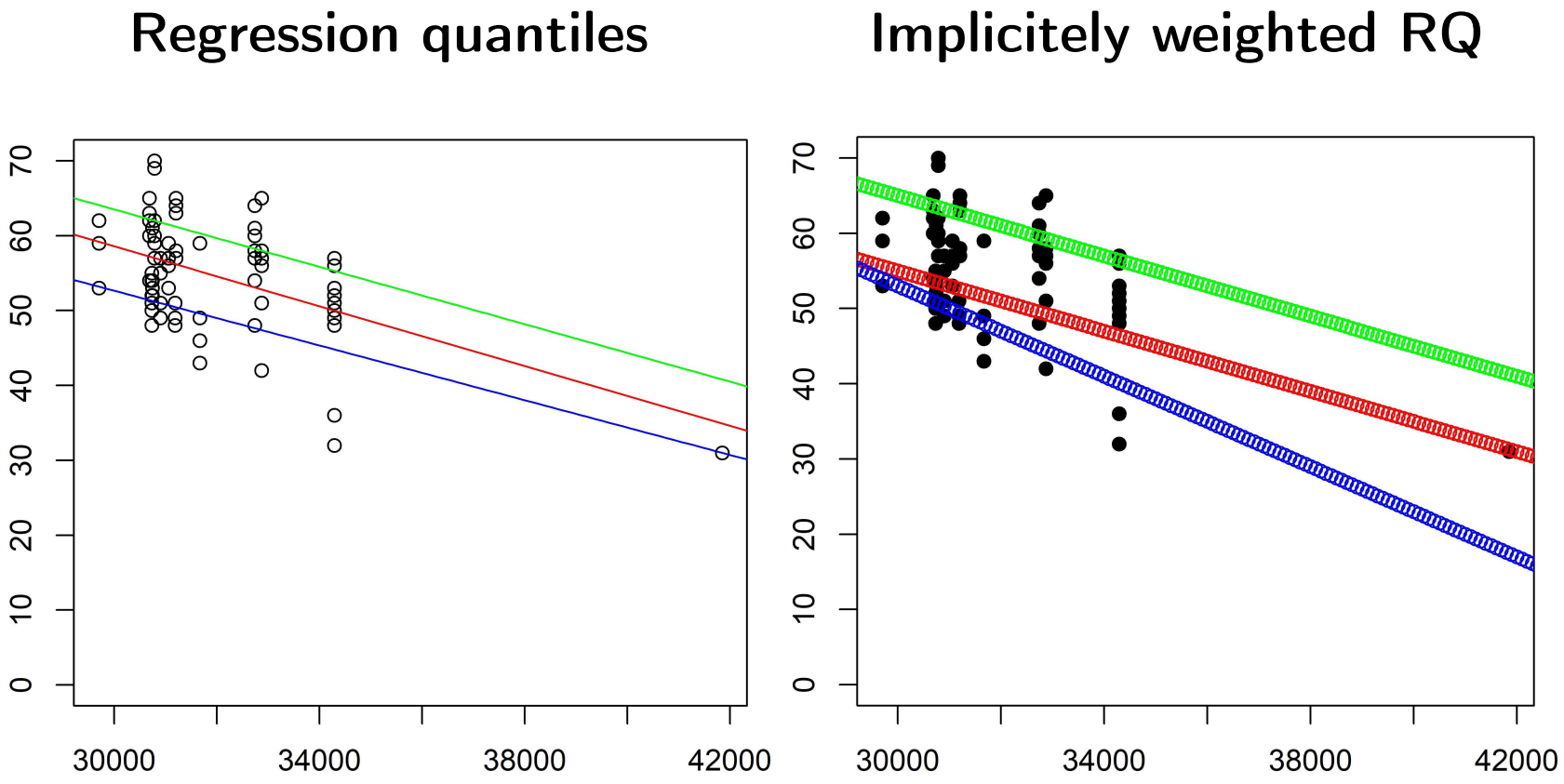
Map of average wage



Linear regression

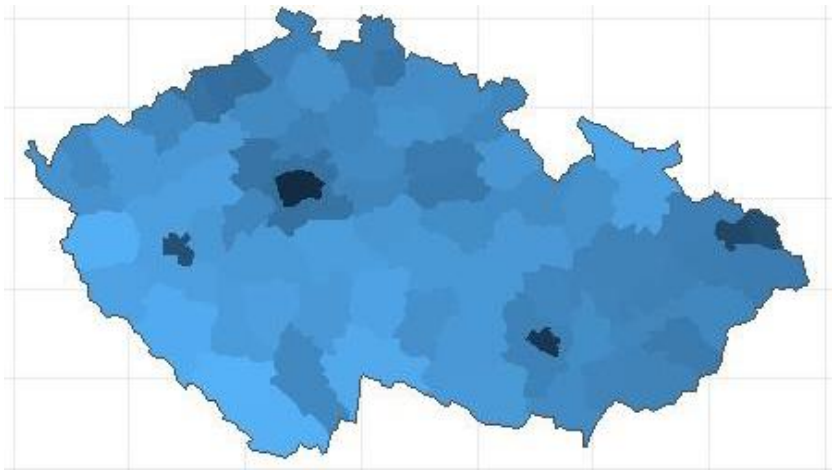


Regression quantiles (X1)

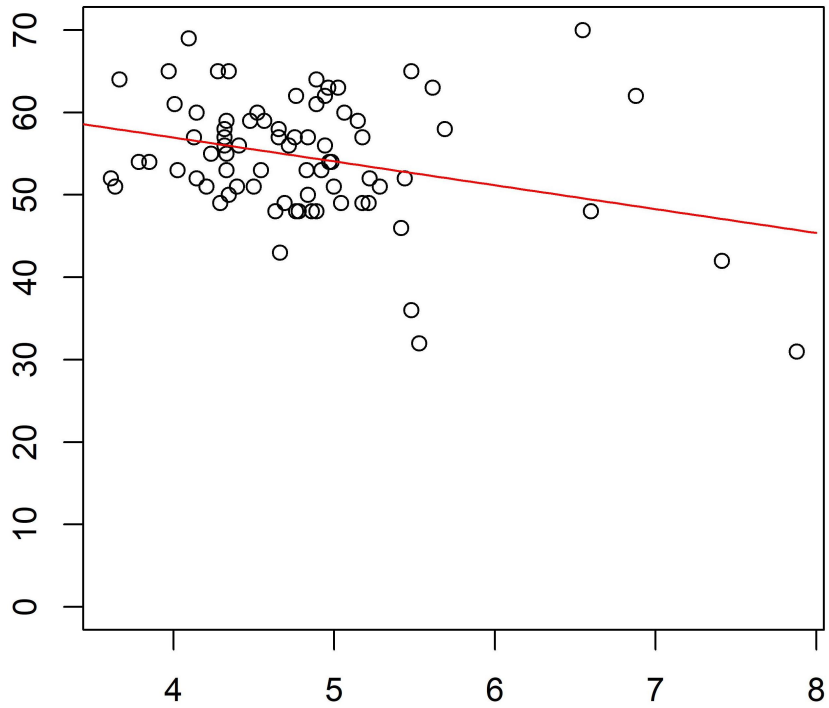


Results (X2)

Map of population density (logarith)

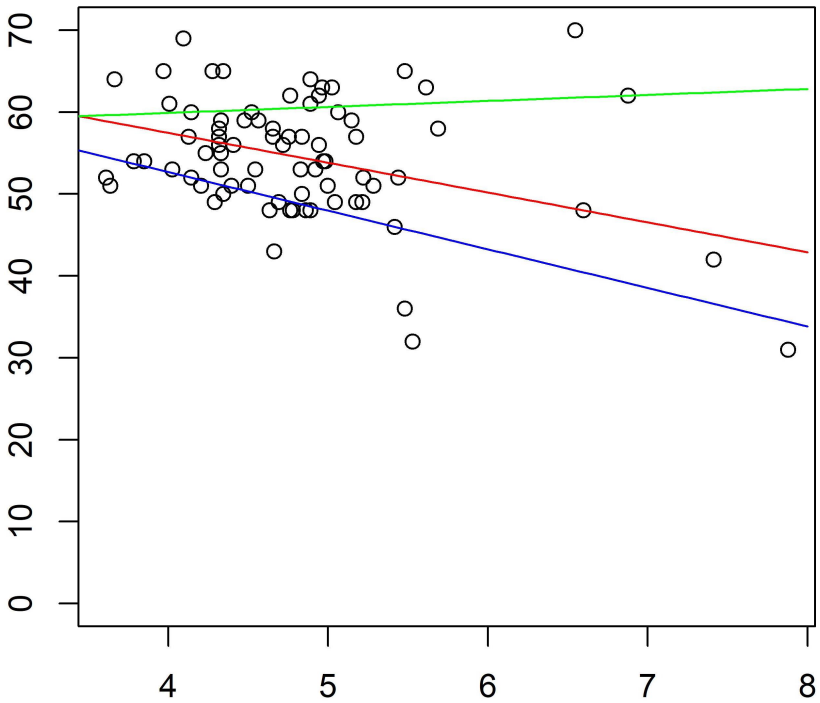


Linear regression

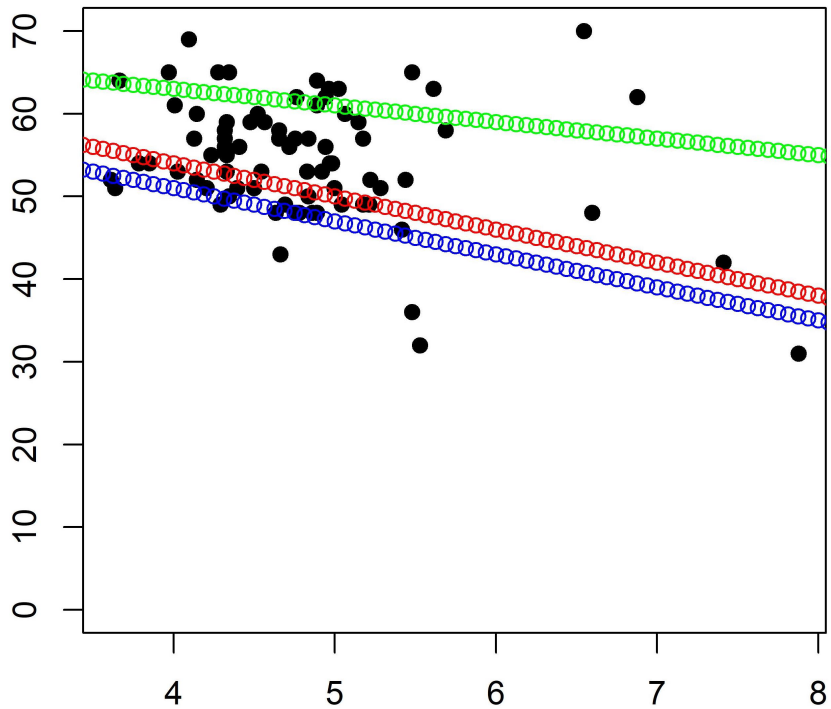


Regression quantiles (X2)

Regression quantiles

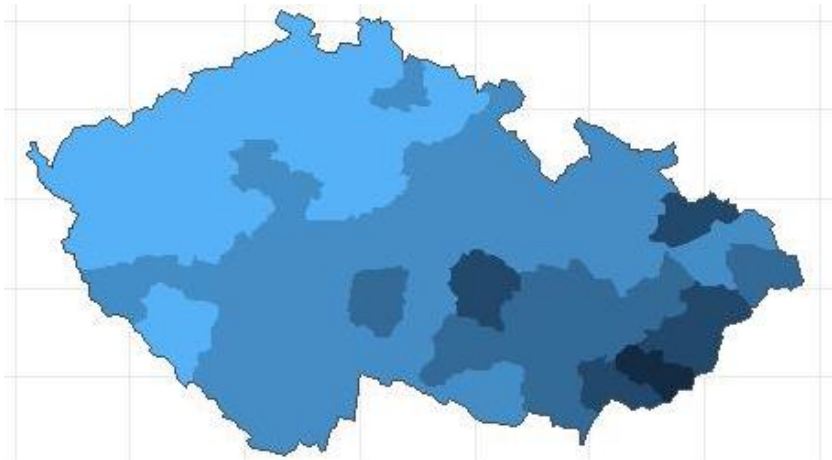


Implicitely weighted RQ

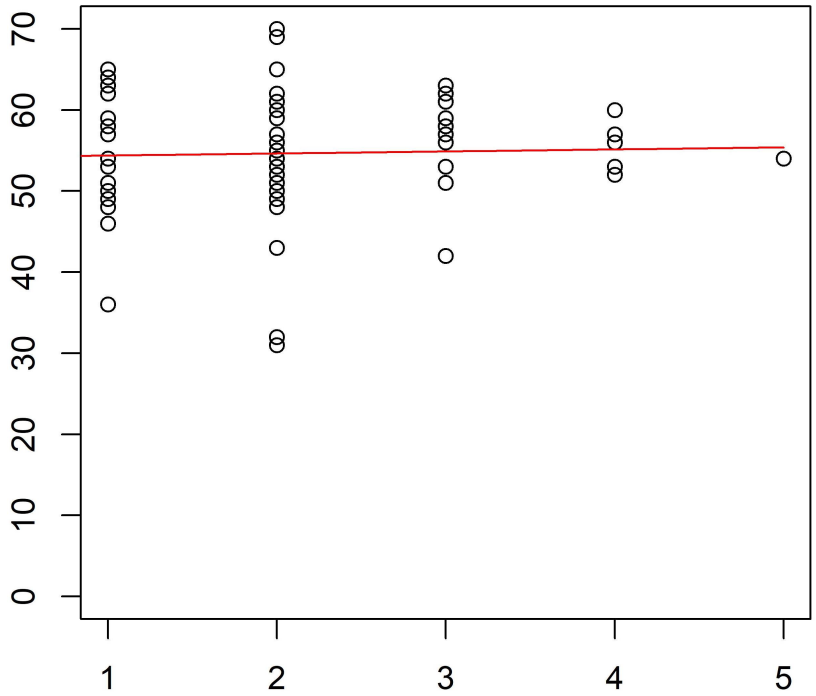


Results (X3)

Map of percentage of believers

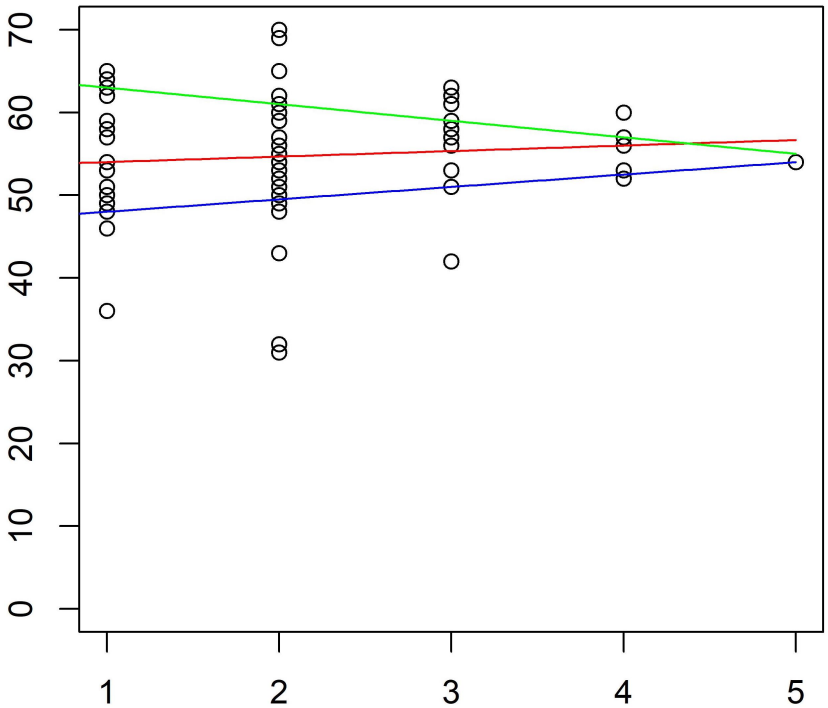


Linear regression

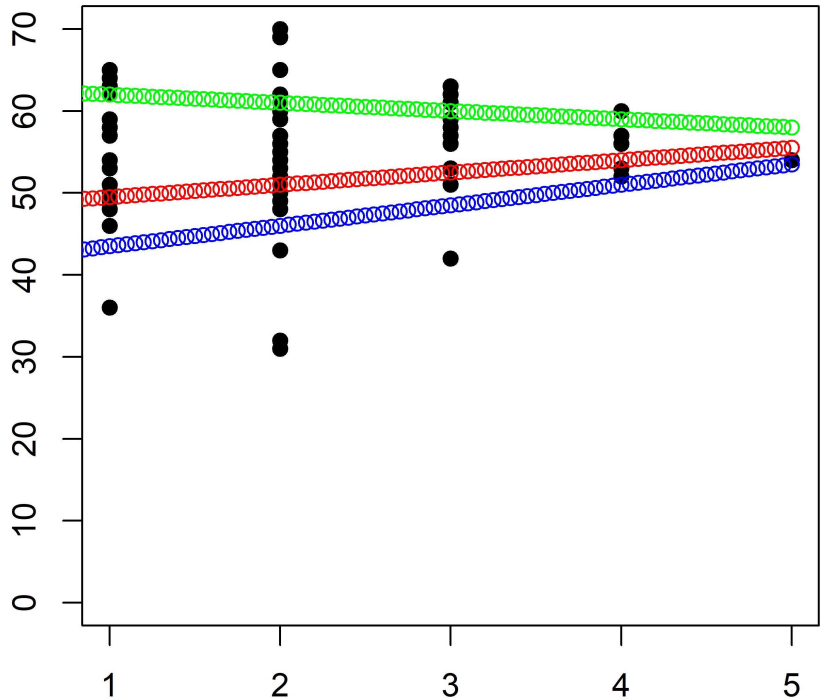


Regression quantiles (X3)

Regression quantiles

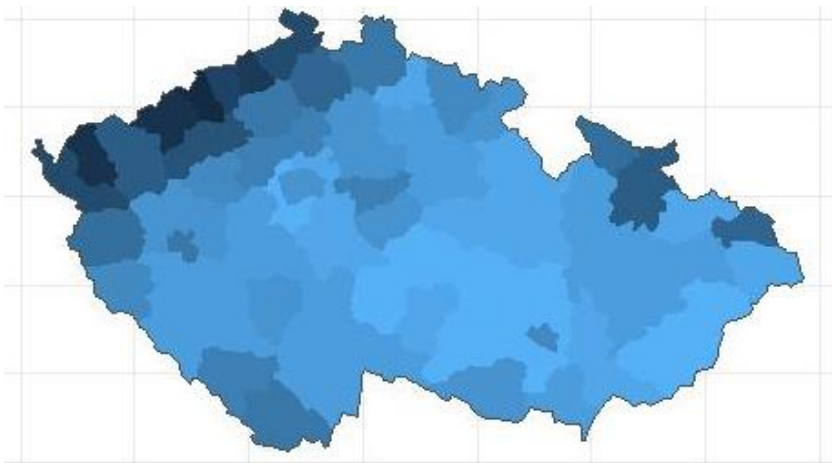


Implicitely weighted RQ

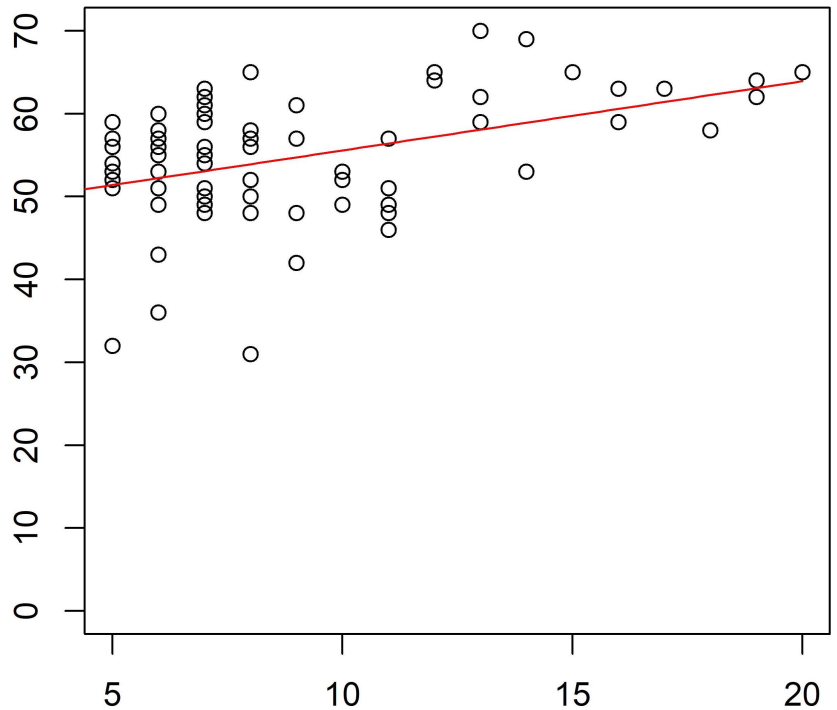


Results (X4)

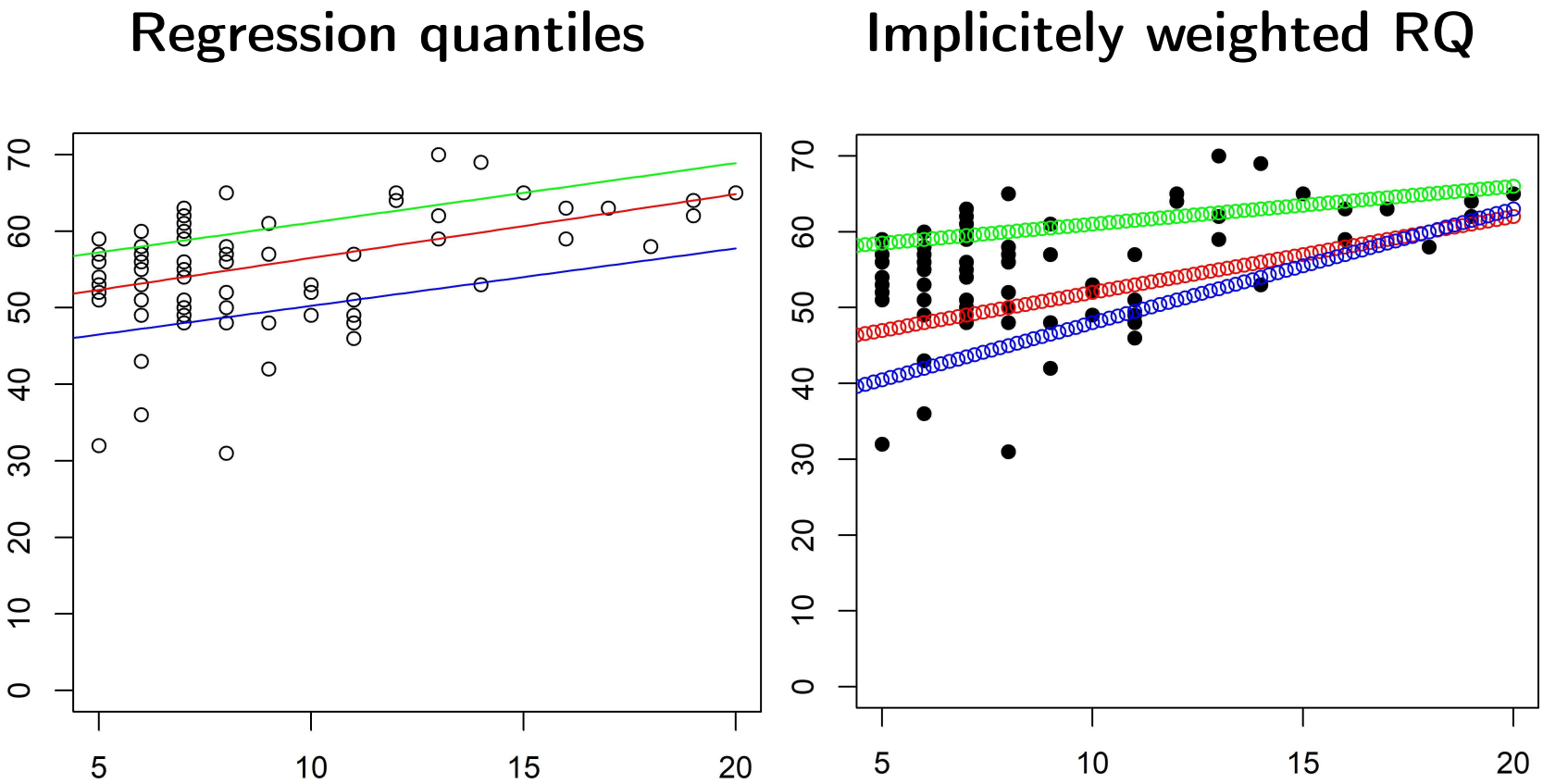
Map of people in execution



Linear regression



Regression quantiles (X4)



Conclusion

- we demonstrated the usage of regression quantiles and implicitely weighted regression quantiles
- implicitly weighted regression quantiles may be beneficial in case of data with leverage points, otherwise they yeal similar results

Thank you! Questions?