

# Evidence of bias in the Eurovision song contest: modelling the votes using Bayesian hierarchical models

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(Joint work with Marta Blangiardo, Imperial College London)

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**Michelle Obama calls for return of Nigerian schoolgirls**



Michelle Obama uses presidential radio address to express outrage at the abduction of at least 200 girls by militant Islamists Boko Haram in Nigeria last month.

FEATURED Culture, Ukraine  
**Nul points! How will Ukraine tensions hit Eurovision voting?**



Will Moscow's involvement in the Ukrainian crisis see Russia hit where it really hurts - the Eurovision song contest? Two statisticians explore the likely voting patterns for Channel 4 News.

FEATURED World, Ukraine  
**Putin sails into Crimea as violence erupts in east Ukraine**



Vladimir Putin arrives in Crimea as a part of Victory Day celebrations, while in eastern Ukraine, where Russia is accused of inciting unrest, Ukrainian soldiers kill

Model behaviour?  
Celebrities speak up in support of photographer Terry Richardson after he was accused of sexual harassment.

LIVE FROM THE NEWSROOM

10 MINUTES AGO

Alex Thomson reports from Donetsk today.



17 HOURS AGO

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On #c4news at 7:20 die in eastern Ukraine clashes, Rolfs "darker side" bit.ly/1hC8zP5, Nigeria kidnap "warning", Apple buys Beats.

6:34 PM - 9 May 2014

Rolf Harris 'Jekyll and Hyde' character who 'molested girls'  
The entertainer Rolf Harris is described as a "Jekyll and Hyde" character who escaped punishment for a string of indecent assaults because "his reputation made him untouchable".

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07 March 2014



- The Eurovision song contest (ESC) is an annual musical competition held among active members of the European Broadcasting Union
- Since 1962, based on positional voting
  - Several iterations until current system:  $S = \{12, 10, 8, 7, 6, 5, 4, 3, 2, 1, 0\}$  points allocated to each act
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- Especially with tele-voting, accusations of bias in the voting system brought forward by several commentators
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- Surprisingly (or not?), there is a relatively large literature on statistical modelling of the ESC voting patterns
  - Broadly speaking, clustering to detect “bloc” or “tactical” voting
  - All in all, evidence seems to suggest specific voting patterns
  - But is this **proof** of bias? Favouritism or discrimination?

- Data on tele-voting available from the ESC website ([www.eurovision.tv](http://www.eurovision.tv))
  - We consider the period 1998-2012 and all countries that have voted in the final round, in this period
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- Covariates
  - $x_{1t}^*$  = Year of the contest (current year–1998; accounts for “external factors”)
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- **NB:** We are not particularly interested in the “effect” of these covariates on the scores
  - Our focus is **not** on predicting the actual votes for next instance of the contest, given the covariates
  - Rather, we use them to **balance** the data and account for potentially different baseline characteristics

- Model:  $y_{vpt} \sim \text{Categorical}(\boldsymbol{\pi}_{vpt})$  [ $v = 1, \dots, 48, p = 1, \dots, 43, t = 1, \dots, T_{vp}$ ]
  - $\boldsymbol{\pi}_{vpt} = (\pi_{vpt1}, \dots, \pi_{vptS})$  [ $S = 11 = \text{number of elements of } \mathcal{S}$ ]
  - $\pi_{vpts} = \Pr(y_{vpt} = s) = \Pr(v \text{ scores } p \text{ exactly } s \text{ votes in year } t) \text{ for } s \in \mathcal{S}$

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- Model the cumulative probabilities:  $\eta_{vpts} = \Pr(y_{vpt} \leq s) = \text{logit}^{-1}(\lambda_s - \mu_{vpt})$ 
  - $\boldsymbol{\lambda} = (\lambda_1, \dots, \lambda_S)$  set of random cut-off points:  $\lambda_s \sim \text{Normal}(0, h^2)$  + ordering constraint so that  $\lambda_1 \leq \lambda_2 \leq \dots \leq \lambda_S$
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- Model:  $\mu_{vpt} = \beta_1 x_{1t}^* + \sum_{c=2}^{C_2} \beta_{2c} x_{2pt}^{(c)} + \sum_{c=2}^{C_3} \beta_{3c} x_{3t}^{(c)} + \alpha_{vp}$ 
  - $\boldsymbol{\beta} = (\beta_1, \beta_{22}, \beta_{23}, \beta_{32}, \beta_{33}) \stackrel{iid}{\sim} \text{Normal}(0, q^2)$  — flat independent prior on the covariates “effects”
  - $\alpha_{vp} \sim \text{Normal}(\theta_{vp}, \sigma_\alpha^2)$ : main parameter in the analysis — represents a **structured effect**, accounting for clustering at the voter-performer level

- Model the mean of the structured effect as

$$\theta_{vp} = \gamma + \psi w_{vp} + \phi z_{vp} \mathbb{I}(z_{vp}) + \delta_{R_{vp}}$$

- $\gamma \sim \text{Normal}(0, q^2)$  = overall intercept
- $w_{vp} = 1$  if countries  $v$  and  $p$  share a geographic border and 0 otherwise  
 $\Rightarrow \psi \sim \text{Normal}(0, q^2)$  = “geographic” effect
- $z_{vp} =$  estimate of migration intensity from country  $v$  to country  $p$   
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- Assume that voters implicitly cluster in  $K$  (fixed number of) “regions”
    - Accounts for similarities in voters’ propensity towards  $p$ , **over and above** geographic and migratory aspects
    - $R_v \sim \text{Categorical}(\zeta)$ , where  $\zeta = (\zeta_1, \dots, \zeta_K) \sim \text{flat Dirichlet}$  = vector of probabilities for clusters membership
    - $\delta_{kp} \sim \text{Normal}(0, \sigma_\delta^2)$  are set of **structured common residual** for each combination of macro-area and  $p$ , which describe the “cultural” effect

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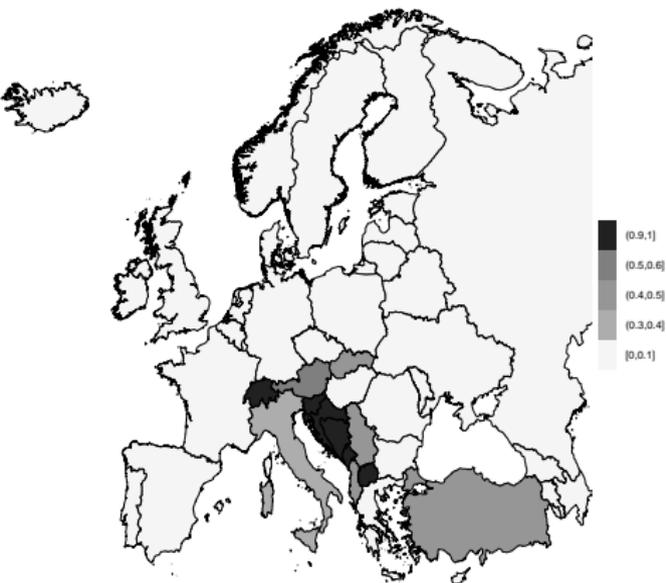
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  - Independent vague priors on the log standard deviation scale
    - $\log(\sigma_\alpha), \log(\sigma_\delta) \stackrel{iid}{\sim} \text{Uniform}(-3, 3)$

- For voters  $v_1$  and  $v_2$  and performer  $p$ ,  $\alpha_{v_1p}$  and  $\alpha_{v_2p}$  determine  $\eta_{vpts}$ , **all other covariates being equal**
  - $\alpha_{v_1p} > \alpha_{v_2p} \Rightarrow$  the chance that  $v_1$  scores  $p$  more than  $s$  points is greater than the chance that  $v_2$  will, for any possible score  $s$

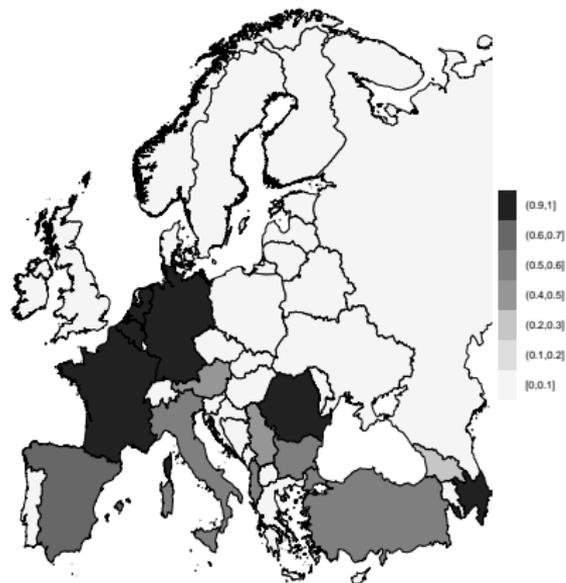
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- In this sense, can use  $\alpha_{vp}$  to quantify the presence of “favouritism” or “discrimination”
  - $\alpha_{vp} \ll 0 \Rightarrow$  voter  $v$  tends to systematically underscore performer  $p$
  - $\alpha_{vp} \gg 0 \Rightarrow$  systematic pattern in which  $v$  scores  $p$  higher votes than other voters

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- **NB:** Difficult to give this a proper “causal” interpretation
  - Cannot establish **deliberate** intervention from the available data
  - Nevertheless, can interpret  $\alpha_{vp}$  as at least *indicative* of the underlying voting patterns

Posterior probability of membership in 'region 1'



Posterior probability of membership in 'region 2'



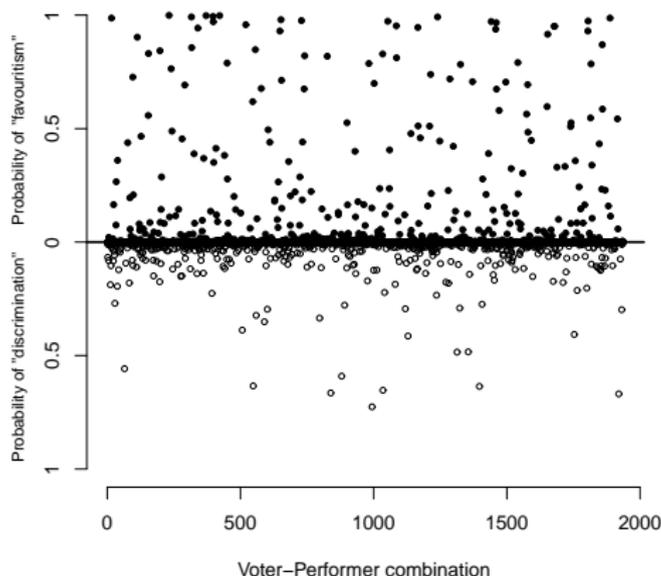
Posterior probability of membership in 'region 3'



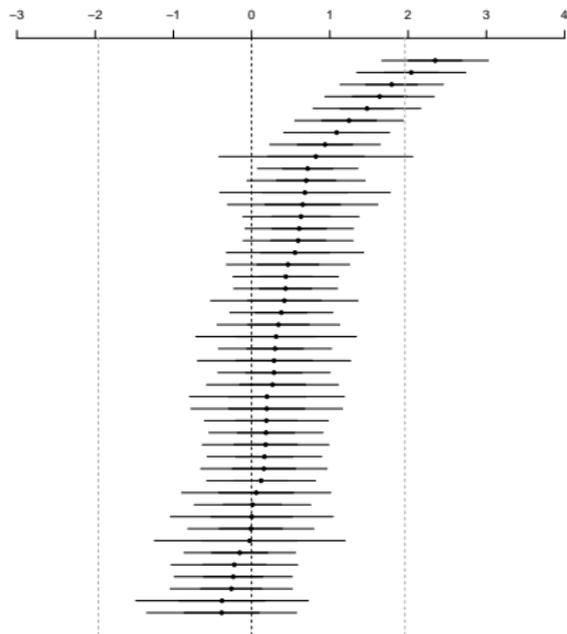
Posterior probability of membership in 'region 4'



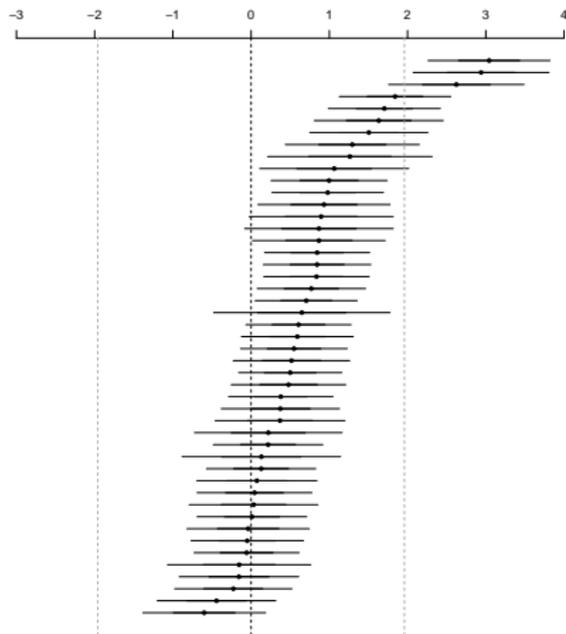
- Compute “standardised” effects:  $\alpha_{vp}^* = \frac{\alpha_{vp} - \bar{\alpha}}{s_{\alpha}} \approx \text{Normal}(0, 1)$ 
  - $\alpha_{vp}^* > 1.96 \Rightarrow$  “substantial” positive bias (“favouritism”) from  $v$  to  $p$
  - $\alpha_{vp}^* < -1.96 \Rightarrow$  “substantial” negative bias (“discrimination”) from  $v$  to  $p$



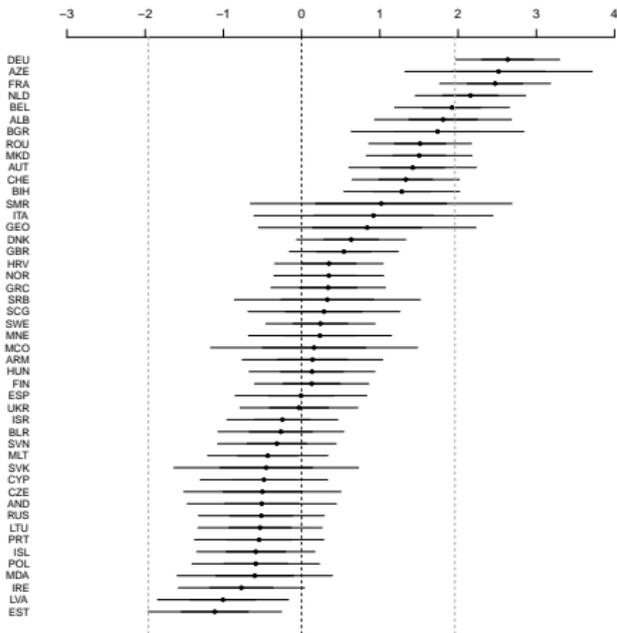
## Propensity to vote for Sweden



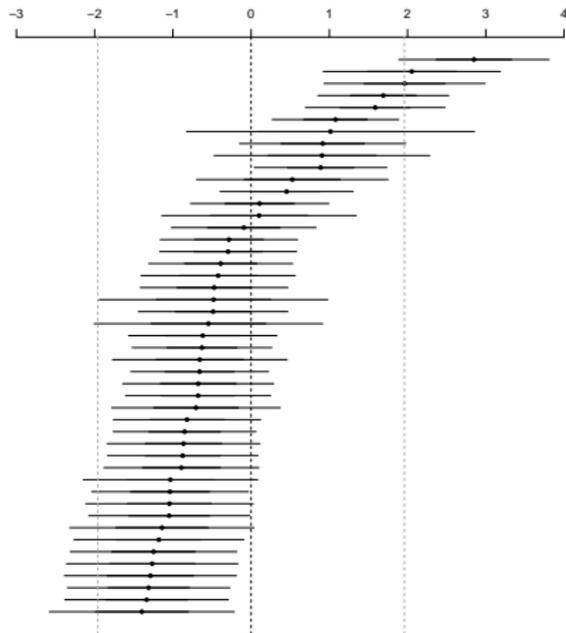
## Propensity to vote for Greece



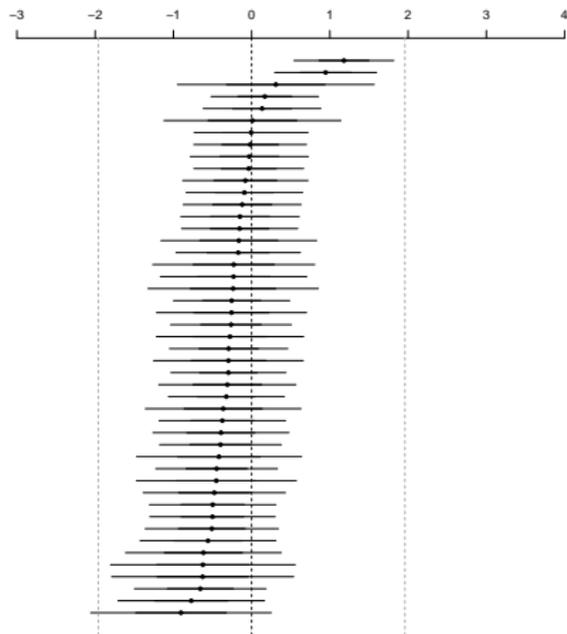
## Propensity to vote for Turkey



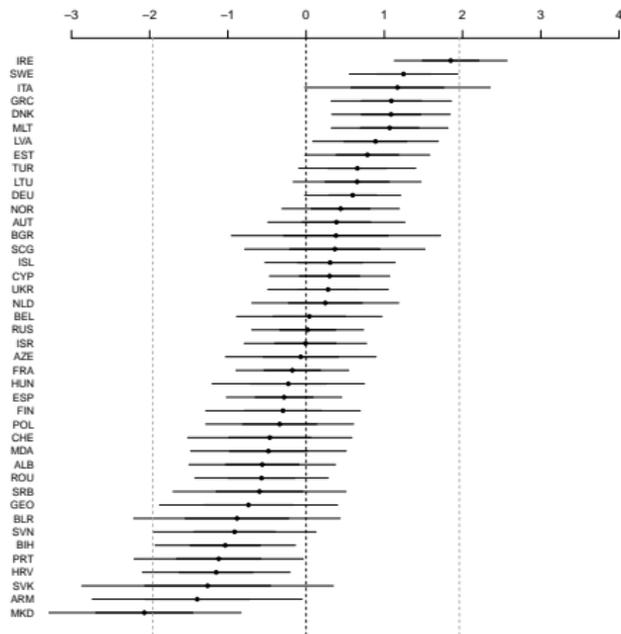
## Propensity to vote for Albania



## Propensity to vote **for** the UK



## Propensity to vote **from** the UK



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- Unmeasured important factors?
  - Media coverage: in the days prior to the final, one entry is usually suggested as the strong favourite
  - May be based on objective qualities of the act, but also hangs on political reasons, eg the willingness to take up the expensive organisation of the next edition

Thank you!