Universality in Voting Behavior

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Universality in social phenomena

- Human societies are characterized by global regularities.
- Transition from disorder to order: spontaneous emergence of languages or cultures, consensus about specific topic.
- Identification of features that are **universal** across systems or phenomena.
- Understanding of regularities at the large scale as a collective effects of the interactions among individuals - *Statistical physics of social systems*, C. Castellano et al., Rev. Mod. Phys. 81, 591-646 (2009)

Elections

- Opinion dynamics among voters $\Rightarrow$ measurable effects.
- Large-scale social phenomena. USA, Brazil, India: several hundreds of millions of voters.
- Election data sets - easily accessible.
- The most studied social phenomena: statistics of turnout rates, detection of election anomalies, polarization and tactical voting in mayoral elections, the relation between party size and temporal correlations, the relation between number of candidates and number of voters, etc.

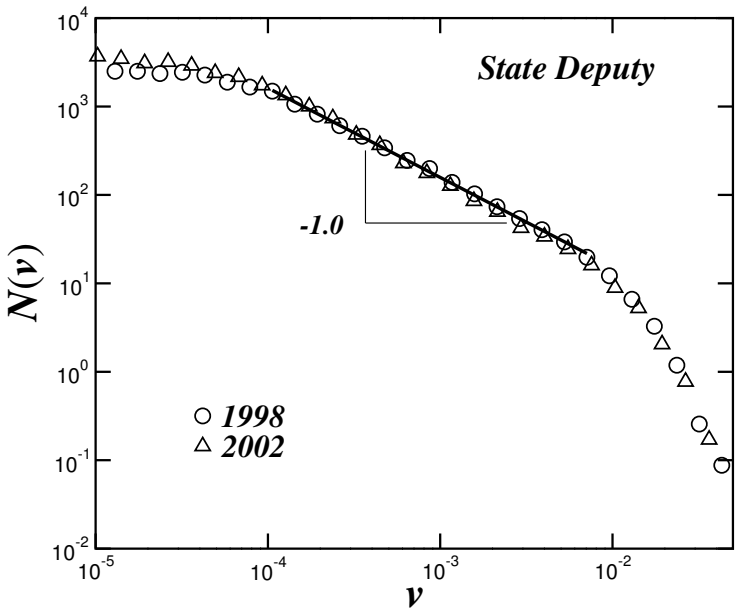
Proportional elections

- The number of seats won by a party is proportionate to the number of votes received.
- Country is divided into multi-member districts. Each district allocates certain number of seats.
- Open and semi-open list systems:
  - Each political party presents a list of candidates for each district;
  - Voters vote for one or more candidates from the list.

Probability distribution of votes

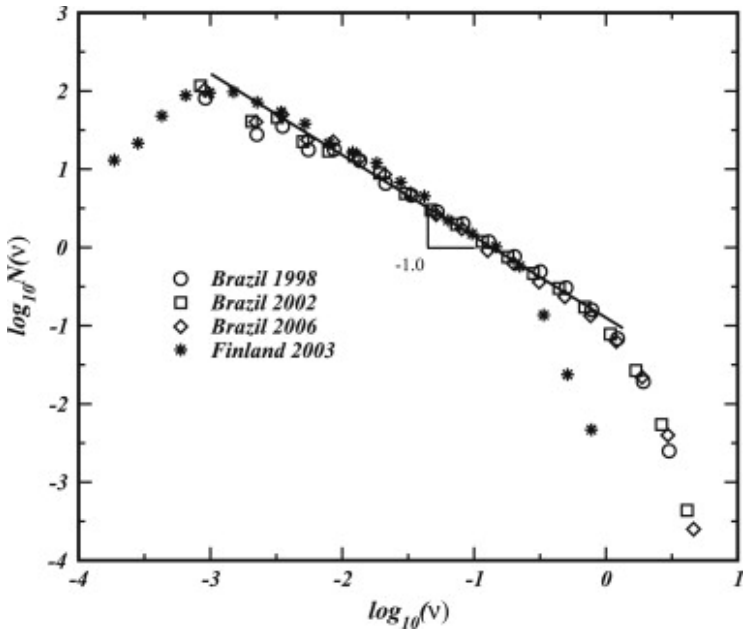
Distribution of fraction of votes v/N_D

Universality: different years.



R.N. Costa Filho et al. Physica A 322, 698-700 (2003)

Universality: different countries (?).

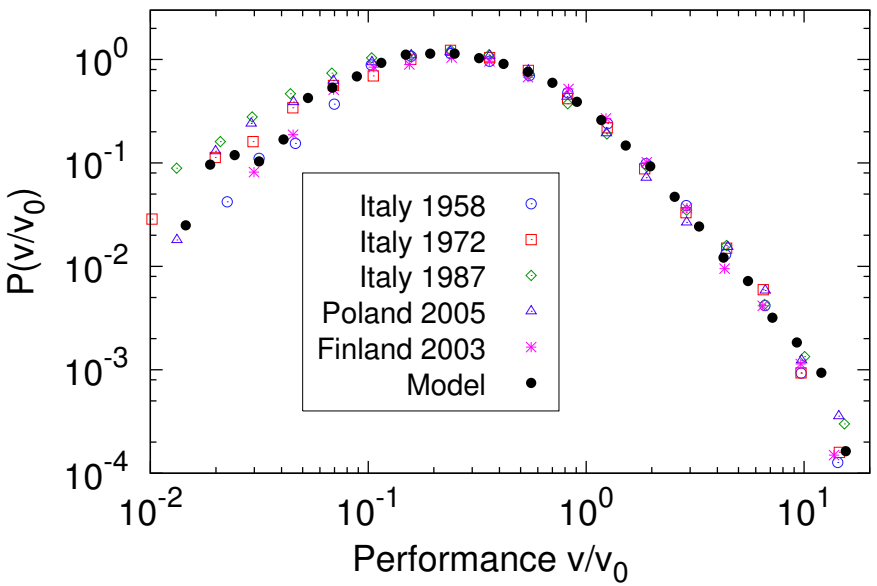


Araripe et al., Physica A 388(19), 4167-4170 (2009)

Candidate performance

The average number of votes won by candidates of the list $v_0 = N_l/Q$. Candidate performance v/v_0

Universality: different countries and different years.



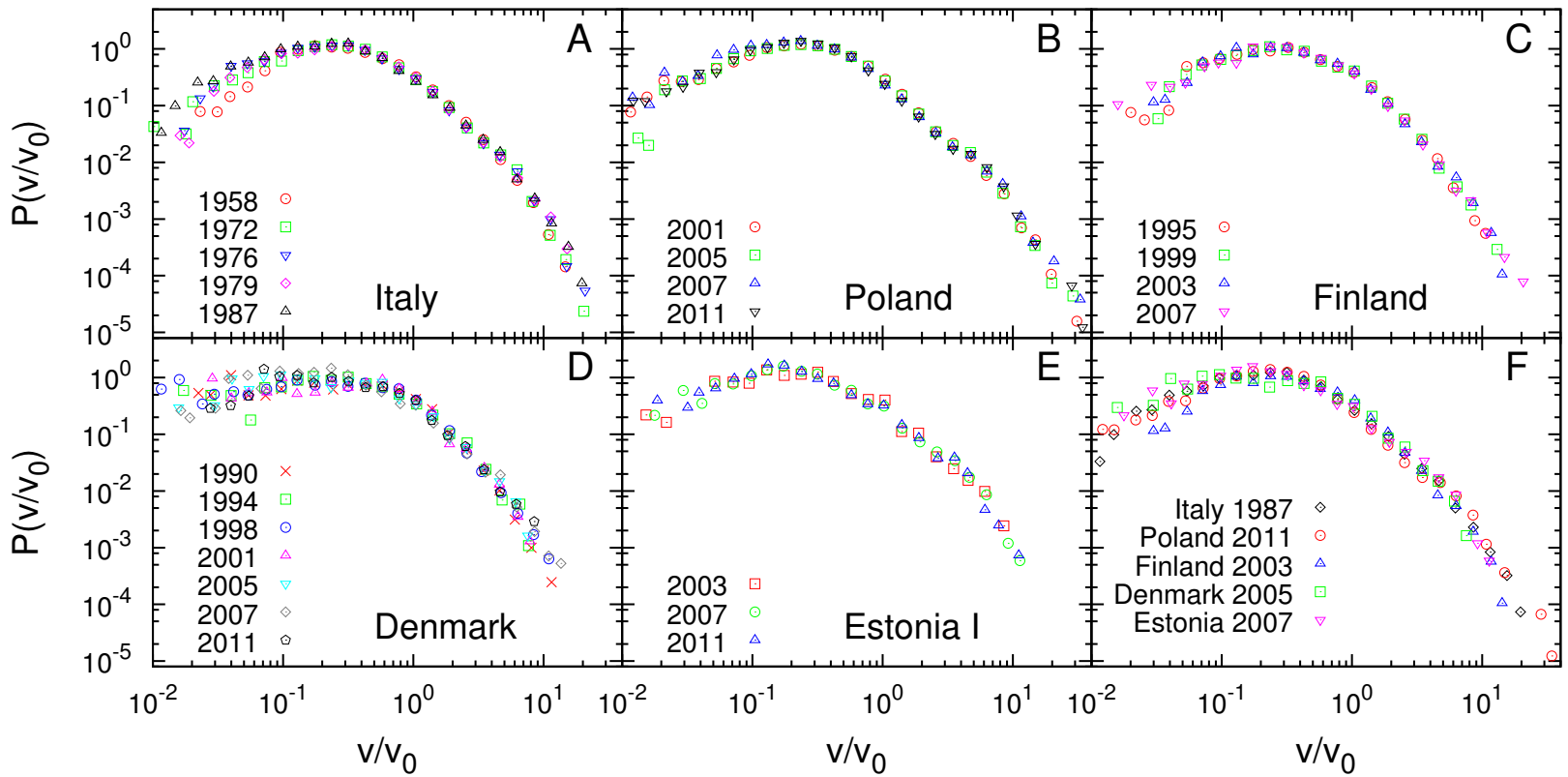
S. Fortunato et al., Phys. Rev. Lett. 99, 138701 (2007)

Questions

- Measure (?): fraction of votes (v/N_D) or candidate performance v/v_0?
- Universal scaling: for which countries, when to expect.
- Data for 15 different countries and different years:
  - **Open list system:** Finland, Italy, Poland, Denmark, Estonia (since 2002), Switzerland, Slovenia, Greece, Brazil, Uruguay.
  - **Semi-open list system:** Sweden, Belgium, Slovakia, Czech Republic, Estonia (until 2002), Netherlands.
- Available data: v_i - number of votes; Q number of candidates on the list; N_l - number of party votes; N_D - number of votes in district; N - number of votes cast in country;

Distribution of candidate performance I

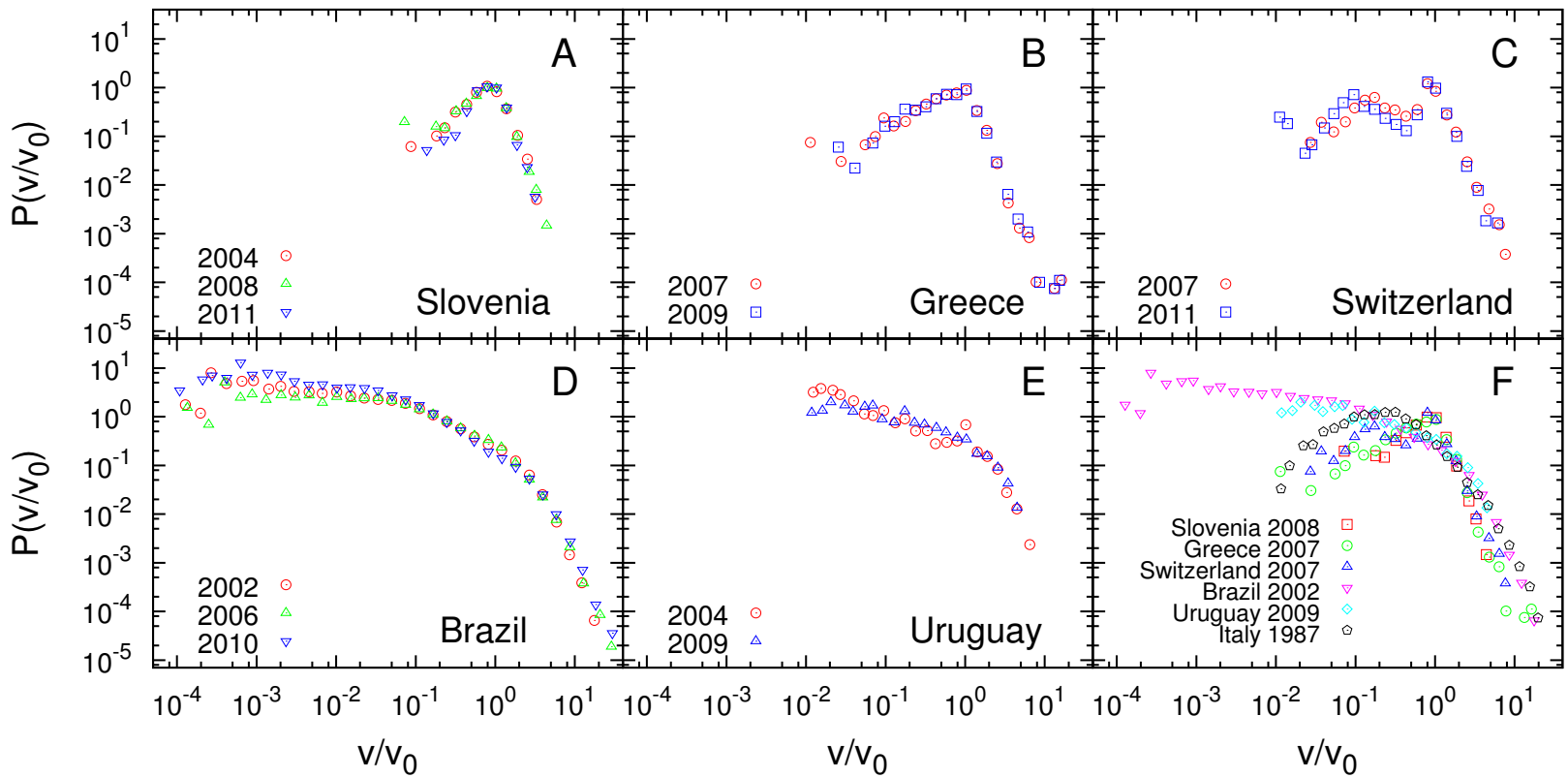
Open lists: Position of the candidate depends only on v. All 5 countries have the same rules.



Universal curve $P(v/v_0)$ within and among nations

Distribution of candidate performance II

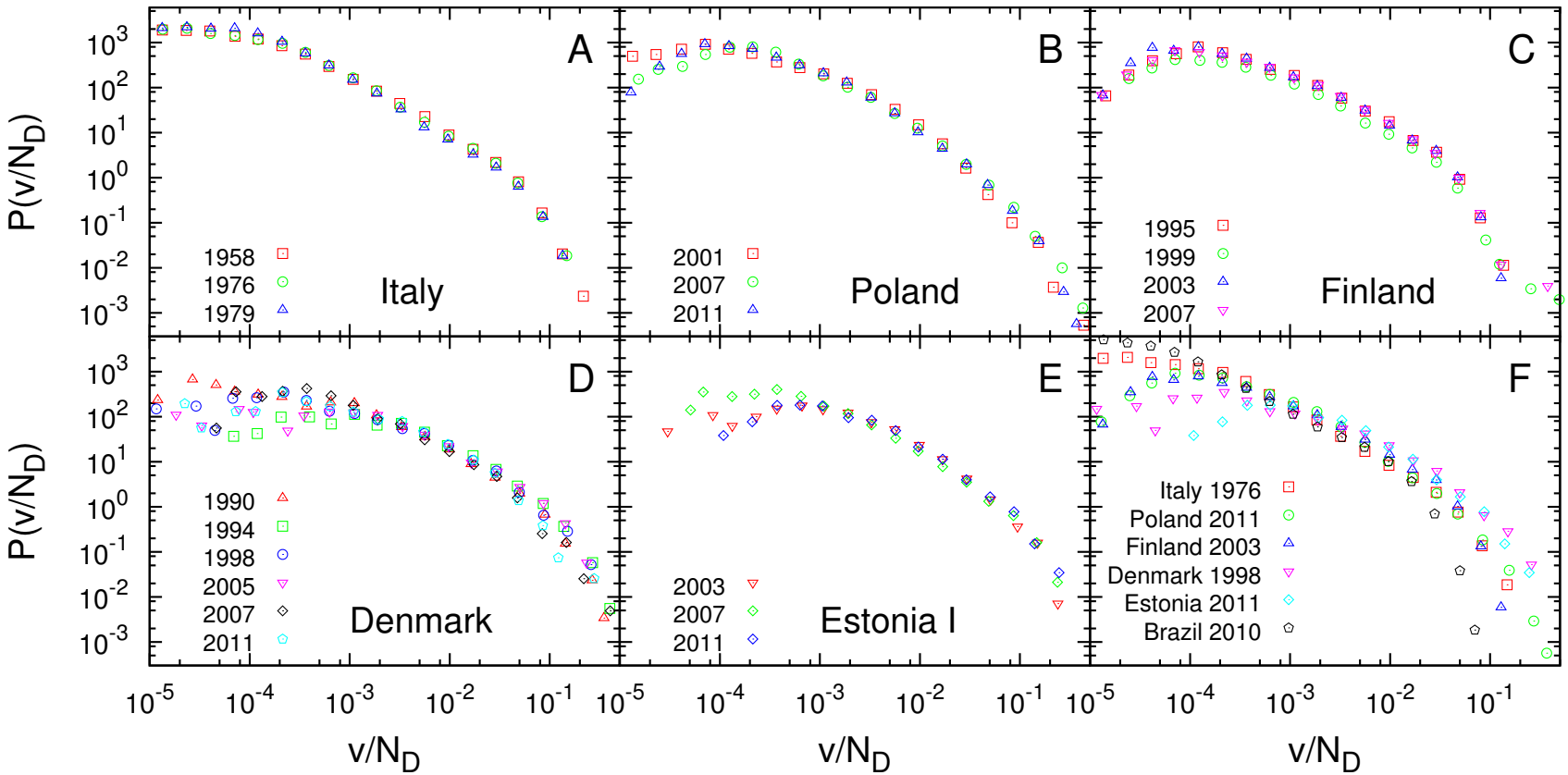
Open lists: Ranking of candidates depends on v and other factors.



Universality within nations.

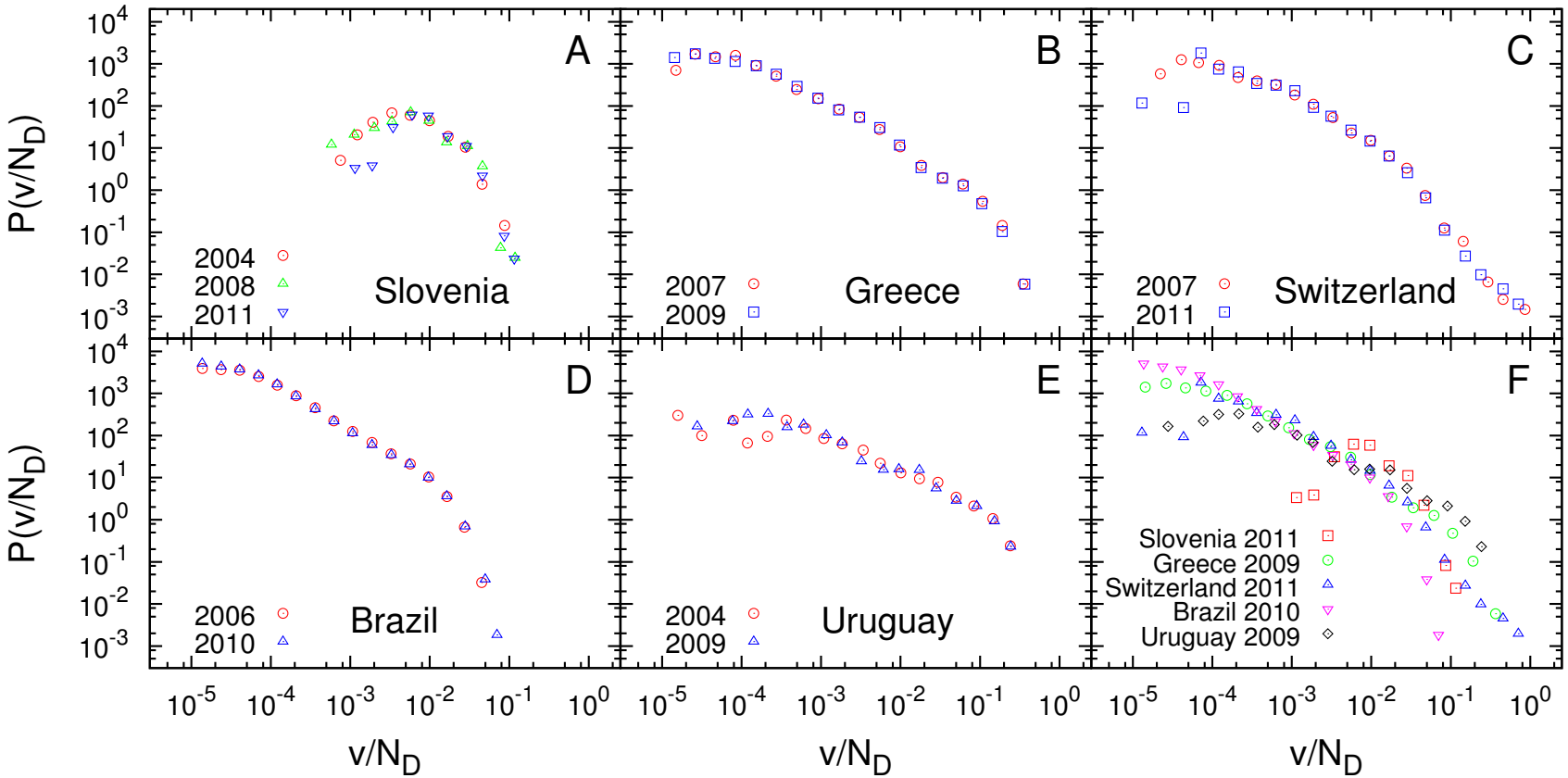
Fraction of votes I

$P(v/N_D)$ for 5 countries with the same election rules.



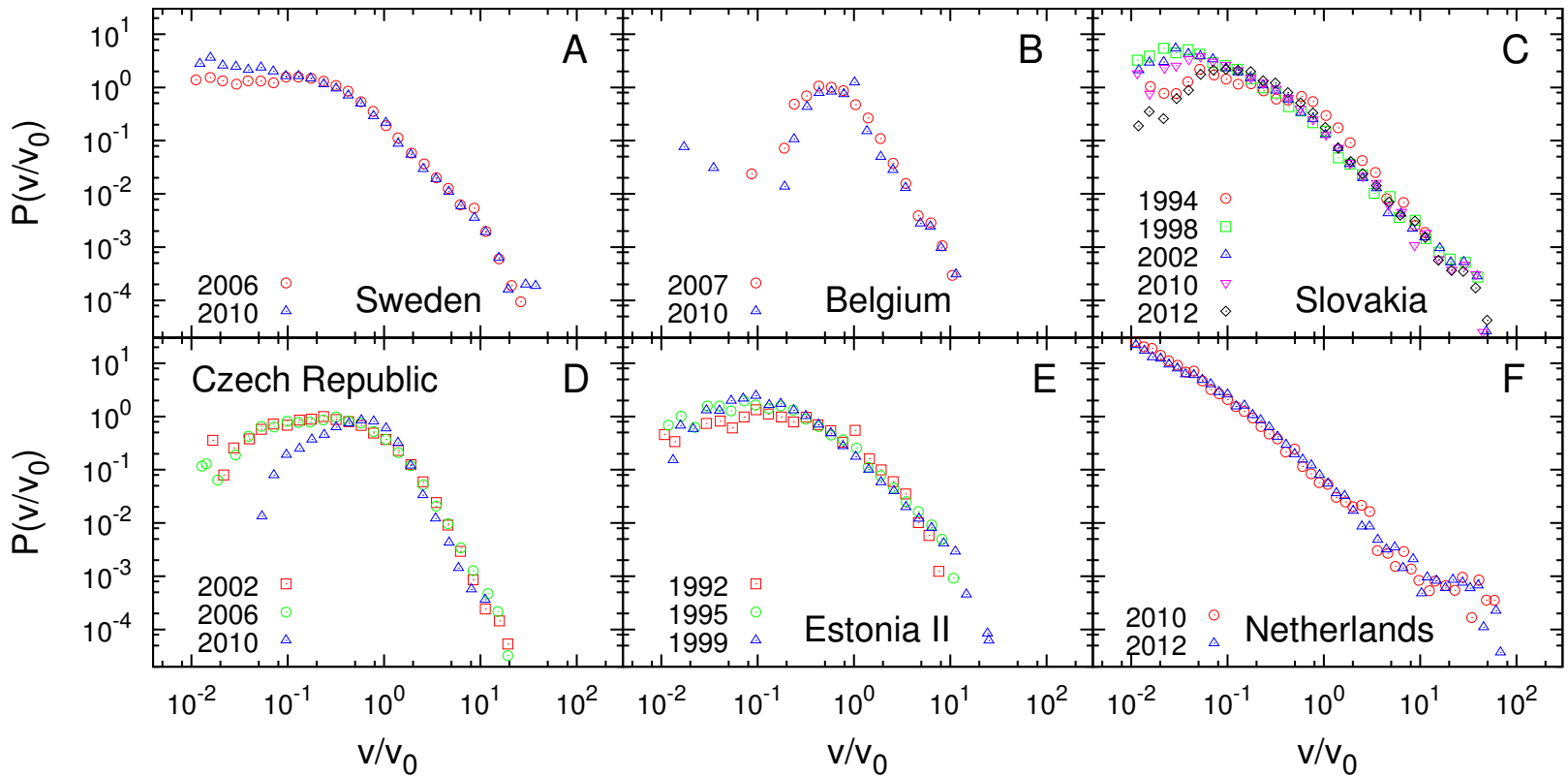
Universality: elections for different years in the same country.

Fraction of votes II



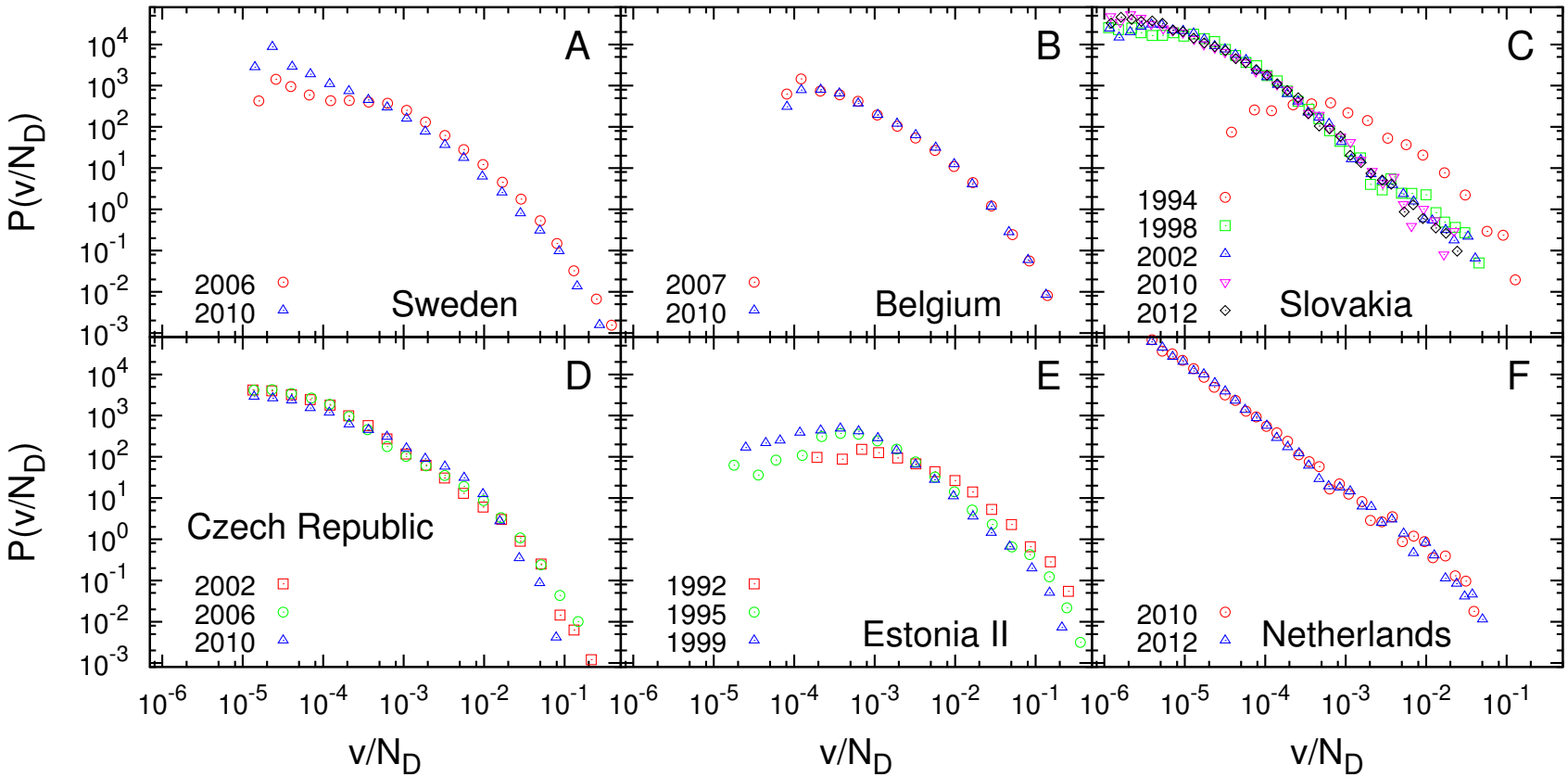
Candidate performance

Semi-open lists: The party determines ordering of candidates. Only candidates with $v > v_{tr}$ are **safe**. Different v_{tr}!



Universal curve for each country.

Fraction of votes



Summary

- Universal signature only emerges when one considers competition between members of the same party v/v_0.
- Nations with the same rules have universal voting patterns.
- Differences from log-normal curve: different election rules, fraud.

Universality in voting behavior

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SUBJECT AREAS:
APPLIED MATHEMATICS
APPLIED PHYSICS
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COMPUTATIONAL SCIENCE

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Universality in voting behavior: an empirical analysis

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Election data represent a precious source of information to study human behavior at a large scale. In proportional elections with open lists, the number of votes received by a candidate, rescaled by the average performance of all competitors in the same party list, has the same distribution regardless of the country and the year of the election. Here we provide the first thorough assessment of this claim. We analyzed election datasets of 15 countries with proportional systems. We confirm that a class of nations with similar election rules fulfill the universality claim. Discrepancies from this trend in other countries with open-lists elections are always associated with peculiar differences in the election rules, which matter more than differences between countries and historical periods. Our analysis shows that the role of parties in the electoral performance of candidates is crucial: alternative scalings not taking into account party affiliations lead to poor results.