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DISTRIBUTION OF VOTES IN ALBANIAN PARLIAMENTARY ELECTIONS
SHPERNDARJA E VOTAVE NE ZGJEDHJET PARLAMENTARE SHQIPTARE

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PERMBLEDHJE
Në këtë punim ne studiojmë sjelljen e numrit të votave të marra nga subjektet zgjedhore në proceset elektorale të 10 viteve të fundit në Shqipëri. Jepet denduria e marrjes së përqindjeve të ndryshme të votave nga këto subjekte për zgjedhjet parlamentare. Në shpërndarjet e votave për zgjedhjet në Shqipëri identifikohen dy regjime. Përqindjet e ulëta kanë një shpërndarje fuqi me eksponent rreth -1.7. Si rregull në këtë regjim gjenden rreth 80% e pikave, ndërsa me to lidhen 20% e votave. Rezulton se në këtë këtë regjim gjenden votat e subjekteve të vogla. Regjimi tjetër që shtrihet në zonën 15-85% të votave karakterizohet nga shpërndarje Gausiane me bisht të gjatë dhe u korrespondon subjekteve të mëdha. Disa qarqe (Shkodër, Kukës, Berat, Dibër, etj,) shfaqin shpërndarje krejtësisht fuqi, ndërsa në disa të tjerë (Tiranë, Durrës, Elbasan, Korçë) kemi prezencën e Gausianit.
Fjalë kyçe: proces zgjedhor, shpërndarje, ligj fuqi, Gausian.

SUMMARY
In this paper we study the behavior of the number of votes cast for different electoral subjects in the Albanian elections of the last 10 years. We report the frequency of obtaining a certain percentage (fraction) of votes versus this fraction for the parliamentary elections. In the distribution of votes in Albania we identify two regimes. In the low percentages we see a power law distribution, with exponent about -1.7. In the power law regime we find over 80% of the points, while they relate to 20% of the votes cast. Votes of the small electoral subjects are found in this regime. The other regime includes percentages from 15% to 85%, and has Gaussian distribution, followed by a long tail. It corresponds to big parties. Some districts (Shkodër, Kukës, Berat, Dibër, etc.) exhibit a distribution that is entirely power law, while in others (Tiranë, Durrës, Elbasan, Korçë) the Gaussian is present.
Key words: electoral process, distribution, power law, Gaussian.

INTRODUCTION

There is a class of systems, traditionally not studied by physics, in which details or history might not influence the global behaviour, e.g. individuals in a community may have opinions that take on two or few values about an issue, such as agree/not agree, seller/buyer, believer/atheist, Linux/Windows, left/right, etc. in all cases evolution drives the system toward a final state, in which one can identify the dominant opinions. In these cases the evolution of the system can be described very well using the techniques and tools of statistical physics [20]. Statistical physicists who study opinion dynamics aim to identify states of the opinion of population, and to know the elementary processes that determine transitions between them, in order to understand the mechanisms and nature of the interaction that produces a certain ordering. This resembles a return to the origins of statistical physics in the 19th century, when Maxwell and Boltzmann were inspired by social statistics, and founded statistical physics.

In 1952 R.B. Potts [15] proposed a model where each agent (spin) can take on one of the q possible values of opinion (orientation) (1, 2, ..., q), and where the interactions with the neighbours favour parallel orientation. For q=2 this model gives the well-known Ising model [10] of ferromagnets. The analogies between the two models: Potts and Ising inspired an elegant simplification, known as the voter model [3, 9]. In this model each node (agent) has two possibilities of "orientation" related to a given issue. Each time step a node i, picked at random, takes on the opinion of their neighbour j, and the process goes on forever. This model has analytical solution in any dimension d.

In the real life there are individuals who do not change their opinion. Taking this into consideration, the voter model has been changed by introducing to it the presence of "zealots", i.e. spins that never change their orientation [12]. For d≤2 the zealot node influences the whole system, and their opinion is adopted by the whole community [13]. For higher dimensions the situation is more complex. If there are many zealots in the system, consensus is never reached, and the distribution of magnetisations is Gaussian with width of the order √(1/z), where z is the number of zealots [14]. Another modification that makes the model more realistic is that is which agents can be in one of three states: left (A), right (B), and centre (C), but only the centrists can interact with other species [19]. Depending on the initial conditions, this model produces finite probabilities of finding the system in one of the possible states, or in a mixture of those.

There are several other models, that we are describing here briefly. *Majority rule*. In a community of N agents, whose opinion can have one of two values, the opinion of a node will be determined by the opinion of the majority of a group of his r neighbours [6]. The system converges toward consensus as logN. This model has been modified further [7, 1]. *Sznajd model.* In this model [17, 18] a pair of nodes with the same value of spin (individuals who agree with each-other) persuade their neighbours, or, if they can not agree among them, (have different orientations of spin) then nothing is changed in the configuration of opinions. *Models with continuous values of opinion* consider a continuous spectrum of opinions s[0, 1]. The most widely discussed are models Deffuant and Hegselmann-Krause. In the Deffuant model [4] rules are such that, if a pair of agents (i, j) have opinions that differ by more than a threshold value, nothing changes in the system, otherwise their opinions will change in a way that their difference is reduced by an amount that depends on their difference from an "opinion of convergence". The Hegselmann-Krause model [8] is similar to this, except that in this case the interaction happen when the neighbour's opinion is within a surrounding area of the opinion of the central node.

What about the election results in the real world? The first empirical study was done in the case of the Federal elections of 1998 in Brazil [2], where was reported a power law distribution of the fraction of votes obtained by candidates according to Zipf law $P(v) \sim v^{-1}$. This result was reconfirmed in the elections of 2002 [11]. This results is reproduced if the fraction of votes is treated as a product of n independent "persuasive" sub-processes with the electors, each of which succeeds with probability p_i. The same distribution was later obtained as a result of dynamics of the modified Sznajd model in a scale-free network. Later studies have shown that the 1/v law is not universal [1]. Exponents that are different from -1 have been found in the case of German, French, Polish, and Italian elections [5]. These countries use proportional electoral systems with open lists. If the list of Q candidates has obtained N votes, the quantity $v_0 = \frac{N}{Q}$ gives the average number of votes per candidate, and the ratio $\vartheta = \frac{v}{v0}$ characterizes the performance of the candidate [5]. The mechanism that produces this distribution is of the "word of mouth" type: the dynamics starts with the candidate, who has a well-defined opinion (they vote for themselves), and then spreads this opinion to other voters. They are persuaded with probability r<1. The voters are modelled by a branching process [16]. This dynamics reproduces a lognormal distribution which, in the large dispersion limit, is reduced to power law.

RESULTS OF ALBANIAN ELECTIONS

The general elections of 2001 and 2005 used a mixed system: majority (first past the pole, FPP) and proportional, regulated by the formula $N_i = 140*(A_i - B_i)/(40+c)$, where N is the total number of seats in the parliament, A is the proportion of vote for subject i, B is the number of seats won in the FPP voting, and c is the total number of seats won by independent candidates, and the subjects that do not pass the threshold. In 2009 the voting system was proportional with closed lists. In all cases the candidates' lists were pre-ordered, i.e. closed. The quantity we study is the fraction of votes obtained by electoral subjects $p(v_i/N)$ where v_i is the number of votes won by that electoral subject in a polling unit.

Originally we considered the distribution of the FPP votes, based on electoral districts. Here we observe a power law distribution within the first 20% of the votes. The power law exponent is roughly -1.3, and stays the same for the elections of 2001, 2005 and 2009, independently of the voting system used. The rest of votes (20-100%) exhibits a "hill" that seems to resemble a lognormal curve, but the number of points is insufficient, so we could not get a reliable conclusion (Fig. 1).

Then we studied the results based on polling stations, hoping that in this case there will be enough experimental points, in order to get a good statistics. We had to experiment with the length of the binning interval. Results based on electoral districts and polling stations agree when the length of the binning interval is such that the whole interval 0-100% of votes is divided into 60-100 parts, for the electoral districts results, and 100-1000 parts, for the polling stations results. It is worth noting that, as the number of binning intervals for the polling stations results grows, at first the power law exponent grows, and then (for more than 200 binning intervals) it stays constant. We are reporting these values, obtained for lengths of binning intervals, for which the parameters are constant. Results that follow correspond to 60-100 binning intervals, and the borderline between two regimes (power law and the "hill") at about 15-20%.

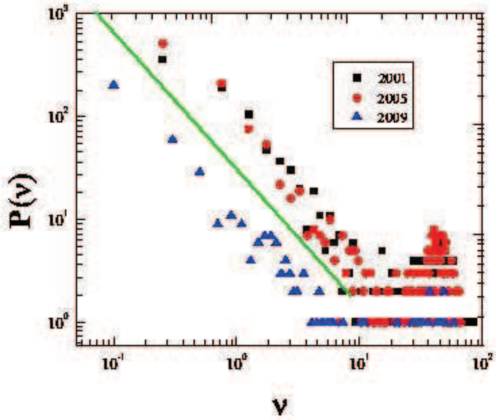

Figure 1: Distribution of votes in the FPP elections, based on electoral districts.

For the FPP elections the power law exponent is about -1.7. In this regime we find 75%-84% of the candidates (points), while it includes the first 20% of votes (Fig. 2). The size of the polling station influences the smoothness of the curve, and we see that the distributions appear quite smooth for polling station sizes above 200 voters.

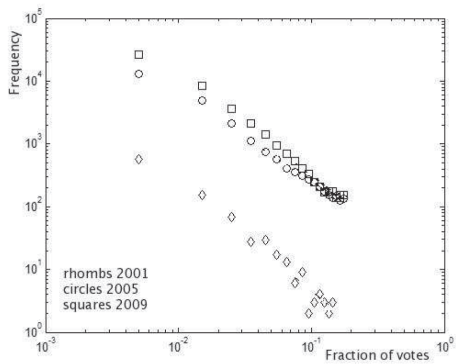

Figure 2. Distribution of votes in the low percentages regime (power law) for the FPP elections (log-log axes).

The distribution for high percentages is Gaussian, and its width corresponds to z ≈ 2 (1.7 - 1.9). For higher percentages we observe a "long tail" that resembles the tail of a lognormal distribution (Fig. 3). This might be due to "rare events" of objective or subjective origin.

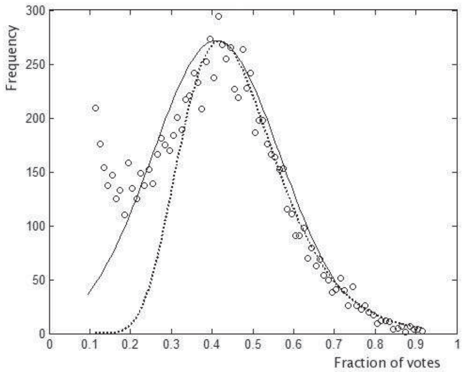

Figure 3. Distributions for large percentages. Continuous line: Gaussian approximation, dotted line: the lognormal curve.

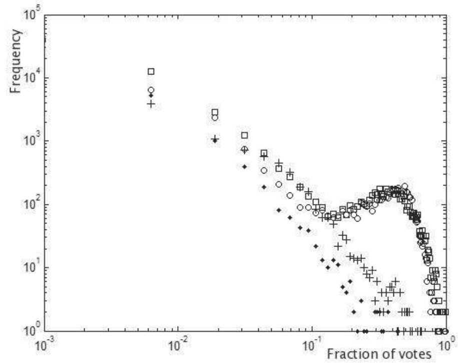

Figure 4. Distributions for coalitions (2009): squares: DP coalition, circles: SP coalition, filled circles: small right wing coalition, pluses: small left wing coalition (log-log axes).

Even though the voting system used in the 2009 elections was proportional (within the districts), the distribution of votes is similar to that of 2001 and 2005 elections. For these elections we studied the distributions for each subject and district. The distribution of DP votes agrees well with a Gaussian curve, followed by a long tail, while the SP votes exhibit a distribution that resembles a twisted Gaussian, especially for small percentages (Fig. 4 and 5). The other subjects exhibit power law distribution with exponents respectively -1.5 and -2 (Fig. 4).

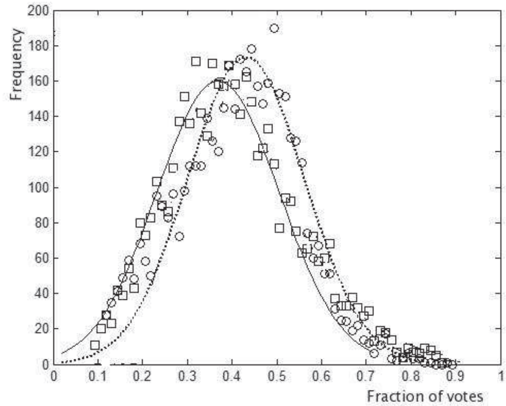

Figure 5. Votes distributions for two big subjects in the 2009 elections: squares: DP, circles: SP.

The distributions vary from one district to another. In some districts, such as Shkodër, Kukës, Berat, Dibër, etc., the votes exhibit power law distribution, while the Gaussian distribution is present in the districts of Tirana, Durrës, Elbasan, and Korça (Fig. 6).

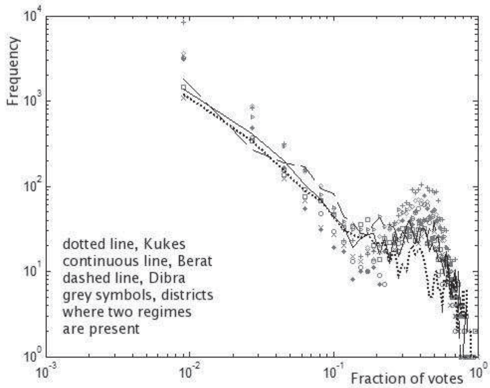

Figure 6. Distribution for several districts (log-log axes). In some of them (Kukës, Berat, Dibër, etc.) we can see that the "hill" is not present at high percentages.

CONCLUSIONS

In the distribution of votes cast in the Albanian elections can be identified two regimes: a power law regime for percentages up to 15-20%, followed by a Gaussian with a long tail, which might indicate the presence of a lognormal. For low percentages the power law exponent is about -1.7. As a rule, in this regime we find about 80% of the experimental points. It comes out that in this regime we find the votes of small electoral subjects. Borders of this regime fluctuate about 20%. The other regime, belonging to percentages from 20 to 85% of votes is characterised by a Gaussian distribution, followed by a long tail. This could be related to the response of the electorate to candidates' performance [5]. The Gaussian behaviour could be attributed to the presence of zealots, i.e. presence of "permanent magnetisations" that correspond to fixed opinions. The long tail that indicates the presence of a lognormal, might be related to a mixture of effects, such as extraordinary performance, or rare events. It appears that voters of big subjects adopt strategic voting, which indicates the presence of a "fitness" parameter, conditioned by the competition between "magnetisation" (zealotry) and "thermal noise" (evaluation of performance) in the system. In this situation it seems of interest to investigate the underlying causes of the observed behaviour. This we plan to do next, through modelling of the microscopic behaviour of the voters, and simulations of the system.

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