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Statistical properties of approval ratings for governments

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HIGHLIGHTS

- We studied the statistical properties of the approval ratings for governments.
- The volatility distribution is generally fitted well by exponential.
- Many time series are self-affine, with positive or negative correlation.

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ABSTRACT

We elucidate the statistical mechanical properties of the approval rating time series of several governments from the social dynamics of complex systems and sociophysics points of view. We find that the distribution of approval rating volatility shows exponential independently on nations. Introducing "volatility temperature" defined with the exponential distribution, it could be understood generally that high and low temperature nations correspond to parliamentary cabinet and presidential systems, respectively. We also find that approval rating time series of many governments shows self-affine fractality with negative or positive correlation. Approval rating time series is typical one of few negative correlation phenomena.

1. Introduction

Complex systems, including nonlinear dynamics, pattern formation, collective behavior, complex networks and so on, has developed drastically over the past 30 or so years [1]. The target of the field is phenomena where interactions between the components play a crucial role. Recently, the assemblage of people has become a new target in this regard. Social dynamics, considered as a subfield of collective behavior, studies social emergent phenomena, which is more complicated than the simple emergence generated by the assemblage of atoms or molecules [1,2].

On the other hand, the field of sociophysics explores, comprehensively from a physics point of view, universality and the fundamental mechanism of the statistical and dynamical properties of social phenomena where many people or agents interact. The subject of sociophysics seems to vary more than that of social dynamics, from, at the microscopic level, the actions of individuals to, at the macroscopic level, the social structure and its dynamics. For example, economics, opinion dynamics, politics, history, and the formations of culture, civilization, language, and society have thus far been studied [3].

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In this paper, we analyze the approval rating time series for governments. In a democratic nation, the political system, characterized by, say, the premier or president and the power distribution of political parties, is decided through an election as a form of consensus dynamics. In such an election, each individual casts a vote, even with an option of not voting, based on many factors including political, economic, and international affairs as well as his or her tastes. It has been reported that the distribution of the percentage of vote of each party is lognormal, irrespective of the political system [4]. A model has also been presented that explains that a political party becomes supported through several direct elections [5]. Above all, the government party, the largest in the assembly, can wield its power directly to form or develop the system and the premier or president belongs to this party in most cases (this may not always be the case for a coalition government). Furthermore, in many democratic nations, approval rating is surveyed regularly as an index of the degree to which people are satisfied with the state of political affairs. We expect that this rating is thus suitable to discuss the characteristics or stability of social systems. To our knowledge, approval rating has not yet been studied from a complex system or sociophysics point of view.

Our studied approval rating for government means the percentage of those supporting not government party but cabinet or president of a nation. It is often pointed out that approval rating depends on sample and polling methods. Accordingly, the differences of approval ratings among nations should be considered carefully. We expect some universality nevertheless.

2. Approval ratings for governments

We discuss the properties of the approval rating time series of several nations. Mainly, we show the case of United Kingdom (UK) government, which adopts a parliamentary cabinet system, as its behavior is statistically simple and typical. We also discuss the cases of some other nations as necessary.

The monthly time series of the rating of the UK government a_n (%) is shown in Fig. 1(a), from the M. Thatcher to the D. Cameron cabinet (August 1979 to March 2013) [6]. While this series fluctuates in the short-term, it gradually decreases in the long-term. We should note that there are lower and upper limits (0% and 100%, respectively), contrary to the stock price studied in econophysics [7], where a lower limit exists but no upper limit. These limits are expected to affect the behavior. The introduction of a lower limit is known to change the distribution, from lognormal to power-law [8]. The average $\langle a_n \rangle$ and standard deviation σ_n of the series from the beginning of the data to the n-th data point is shown in the right inset of Fig. 1, while the ratio $\sigma_n/\langle a_n \rangle$ (self-averaging) of each cabinet and whole series from the beginning are shown in the left inset. We find that the ratio does not converge to zero, implying non-self-averaging effects and the importance of fluctuations in the dynamics [9]. Fig. 1(b) and (c) also show the monthly time series of the rating of 5 presidents of France, from President V. Giscard d'Estaing to President F. Hollande (October 1978 to April 2013) [10], and 26 cabinets of Japan, from the H. Ikeda to the second S. Abe cabinet (June 1960 to June 2014) [11], respectively. The questionnaire can be seen in each website [6,10,11].

Although many premierships or presidencies have set tenures, sometimes, a prime minister has to resign during his/her term. These facts may make statistical analysis difficult, because sufficient data for such an analysis are unavailable.

3. Distributions

3.1. Volatility time series

We investigate the volatility of the approval rating $\gamma_n \equiv (a_{n+1} - a_n)/a_n$, which could change complicated distribution of a_n into simplified one. The volatility time series for France and the UK data are shown in Fig. 2(a) and (b), respectively. As seen clearly from the France data, the set of γ_n can be classified into two subsets: γ_A, at the government change and γ_B, the others. The volatility belonging to γ_A is often bursting, but sometimes indistinguishable from those belonging to γ_B. Predicting a bursting change of a stock price is well known to be impossible. Similarly, it is difficult to predict whether volatility is bursting or not. However, in a presidential system, bursting is more likely than it is in a parliamentary cabinet system, because a supported president is directly elected. Contrary to the France case, there seems only one bursting in the UK case, corresponding to the beginning of the T. Blair cabinet, when the government party changed from Conservative to Labour (Fig. 2(b)). Otherwise, there is no larger bursting, not only in terms of a change in prime minister within the same party (at the inaugurations of J. Major and G. Brown) but also in terms of a government party change (at the inauguration of D. Cameron). This finding means that government change is not distinguished from usual political matters. In this sense, the UK is politically stable. In other nations, the volatility of a government change strongly depends on the personality of the new leader. Sometimes, it even takes a negative value.

3.2. Volatility distribution

The semi-log plots of the distributions of γ_B for the UK and Japan data are shown in Fig. 3(a) and (b), respectively. In the main panels, the distribution of the absolute value is shown, while the positive and negative values are represented separately in the insets. All these distributions are exponential. The reciprocal of the slope τ_B is the average of the distribution and this is regarded as the "volatility temperature" by analogy with the Boltzmann distribution of equilibrium statistical