THE DYNAMICS OF THE RISE AND FALL OF EMPIRES

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Abstract

The rise of empires can be elucidated by treating them as living organisms, and the celebrated Verhulst or Lotka-Volterra dynamics can be used to understand the growth mechanisms of empires. The fast growth can be expressed by an exponential function as in the case of Macedonian empire of the Alexander the Great whereas a sigmoidal growth can be expressed by power law equation as in the case of Roman and Ottoman empires. The superpowers Russia and the USA follow somehow different mechanisms, Russia displays two different exponential growth behaviors whereas the USA follows two different power law behaviors. They both grew up by not much mobilizing and disturbing their social capacity. The decline and the collapse of an empire is a kind of fragmentation process and the consequently formed small states are rather free in their behavior. The lands of the new states formed exhibits a hierarchical pattern, and the number of the states having an area smaller than the largest one can be given either by an exponential or power law function. The exponential distribution pattern occurs when the states are quite free in their pursuits, but the power law behavior occurs when they are under the pressure of an empire or a strong state in the region. The geological and geographical conditions also affect whether there occurs exponential or power law behavior. The new unions formed such as the European Union and the Shanghai Cooperation increases the power law exponent implying that they increase the stress in the international affairs. The viscoelastic behavior of the empires can be found from the scattering diagrams, and the storage (G') and loss modulus (G''), and the associated work-like and heat-like terms can be determined in the sense of thermodynamics. The G' of Ottomans was larger than that of Romans implying that they confronted severe resistance during their expansion. The G' of Russia is also larger than that of the USA; in fact the USA did not face severe resistance as they had an overwhelming superiority over native Americans. The $G' > G''$ indicates solidity in the social structure and Romans, Ottomans, and Russians all have G' larger than G''. The G' is slightly larger than G'' for the USA indicating that they have had a very flexible social structure. By the same token the ratio of the work-like term to the internal energy is larger for Ottomans than that of Romans, and larger for the USA than that of Russia. That means the fraction of the total energy allocated to improve the social capacity is larger for Romans than that of Ottomans, and is larger for Russians than that of the USA.