An Evaluation of Hegemonic Epochs – A Time Series Analysis

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Abstract

The paper aims to present the time evolution of the number of hegemonic states based on a temporal series analysis. The basic idea is that a hegemonic state is the state that culminates by a distinct, universal civilization. As a consequence, the analysis has as basic input data the number and the duration of general recognized civilization. There are identified a general evolution trend and a periodic component. Finally, a prediction is made concerning the number of hegemonic states during the next five-hundred years period.

Keywords: hegemonic state, universal civilization, time series analysis

1. Introduction

Stability of the world depends on the equilibrium established between forces driving it. Those forces are mainly issued from states which imposed their leadership either cultural, economic or military to the rest of the world – the hegemonic states.

For this reason, many researchers in history and sociology were interested in studying the characteristics of hegemonic states, the mechanisms which drive their formation, their influence zones and their evolution or involution in time.

This paper aimed to study by mathematical means the frequency of hegemonic states apparition in order to make predictions concerning the structure of the geo-political world map.

The results obtained until now focused on the number of hegemonic states existing in a given time period, but future research could offer predictions concerning their position.

The history and the sociology didn't elaborate a "definite standard" on what is and what characterize a hegemonic state. This paper is based mainly on the theory and data elaborated by a well-recognized historician – Arnold Toynbee [1], [2]. One of the reasons is that his theories have raised a resuscitated interest in the last years, being used in the writings of very contemporary politicians [3].

2. The hegemonic state and the universal civilization

Accordingly to the theories of Toynbee, a hegemonic state represents a civilization which reached an universality state.

A civilization is actually defined as a cultural entity: language, religion, life style defines a civilization. The universal civilizations of the human history were usually defined by their

religion. This doesn't mean that civilizations could be very exact delimitated or that into a given civilization couldn't subsist groups of people with a religion different of the dominant one.

A civilization is the most extended cultural entity: states, ethnic groups, nationalities, religious groups – all of them have distinct cultures at different levels of heterogeneity. Though a civilization is a group of people with the same cultural concept – defined both by common objectives as language, history, religion, customs, institutions and by their own subjective auto-identification.

People have different levels of identity: as an example, a Roman resident could define itself by various degrees of identity as Roman, Italian, Catholic, Christian, Occidental, European.

This point of view became less obvious in our world, when levels of identity are less discriminatory, but were extremely powerful in former historical phases. Anyway, Toynbee used the identity universal civilization – hegemonic state and defined consequently the following hegemonic states with their respective starting/ ending periods (Table 1).

Table 1: Universal civilizations

N^o	**Civilization**	**Starting year**	**Ending year**
1	Summerian	-2298	-1905
2	Babylonian	-650	-529
3	Indic	-322	-185
4	Synic	-221	172
5	Helenic	-31	378
6	Egiptian (1)	-2070	-1660
7	Egiptian (2)	-1580	-1175
8	Orthodox (Russia)	1478	1881
9	Extreme oriental	1597	1868
10	Occident (1)	1797	1814
11	Occident (2)	1526	1918
12	Andine	1430	1533
13	Syriac (1)	-525	-332
14	Syriac (2)	640	969
15	Extreme Oriental (1)	1280	1351
16	Extreme Oriental (2)	1644	1853
17	Central American	1521	1821
18	Orthodox	1372	1768
19	Hindus (1)	1572	1707
20	Hindus (2)	1818	1947
21	Mynoic	-1750	-1400
22	Maya	300	690

3. A mathematical approach

3.1. Conceptual aspects

A temporal series (dynamic series) consists of a lot of observations resulting from measurements made in successive periods of time [4], [5]. Commonly, it is noted $\{x_t, t \in T\}$,

where x_t data represents consecutive measurements, taken at quasi-equal intervals (hours, days, weeks, etc.). A temporal series illustrates the dynamics of a particular process over time, x_t representing the measured value at time $t \in T$.

Since time is continuous, in time series analysis it is fragmented in equidistant periods: hours, days, months, years, etc., hence it has a discrete character.

The evolutionary time series include three basic components:

i. Trend or tendency (T);
ii. Periodic component or cycle (P);
iii. The random or stochastic component (A).

Under these conditions, it can be considered that a temporal series Y(t) consists of the sum of the three basic components:

Y (t) = T + P + A (summative model)

or from their product:

Y(t) = T x P x A. (multiplicative model)

where: the tendency indicates the ascending or descending change of the evolution of the series, the periodic component includes oscillations (cycles) that are repeated at regular time intervals, with regular or irregular amplitudes and the random component expresses the residue or deviations of the series values from the theoretical values corresponding to the trend.

Time series analysis involves separating the three components and interpreting them.

3.2. Data analysis

The first approach concerned the time distribution of the universal civilization (Figure 1). Numbers in the figure identify the civilizations presented in Table 1. As the figure shows the time density of hegemonic states has increased in the last 2000 years.

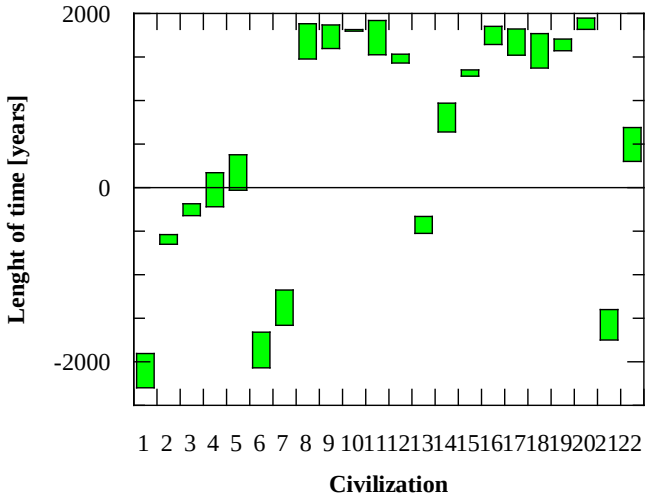

Figure 1: Time density of universal civilization

The representation as time series of the data included in Table 1 resulted in Table 2.

Table 2: Number of hegemonic states/ time

Time interval	Number of hegemonic states (NHS)
-3000 -2500	0
-2500-2000	2
-2000-1500	3
-1500-1000	2
-1000-500	2
-500-0	4
0-500	3
500-1000	2
1000-1500	4
1500-2000	9
2000-2500	3 (estimated value)

The sample period used for the study is one of 500 years – the main reason being the use of the same period in the Toynbee approach.

Figure 2 shows from another point of view the evolution of the density in time of the number of hegemonic states. A "peak" of this evolution appears in the last five hundred years – a historical period in which many states identified themselves as nations and implicitly as civilizations.

Moreover, in Figure 2 could be observed a slight increasing trend of the number of universal civilization and the existence of a certain periodicity of the evolution.

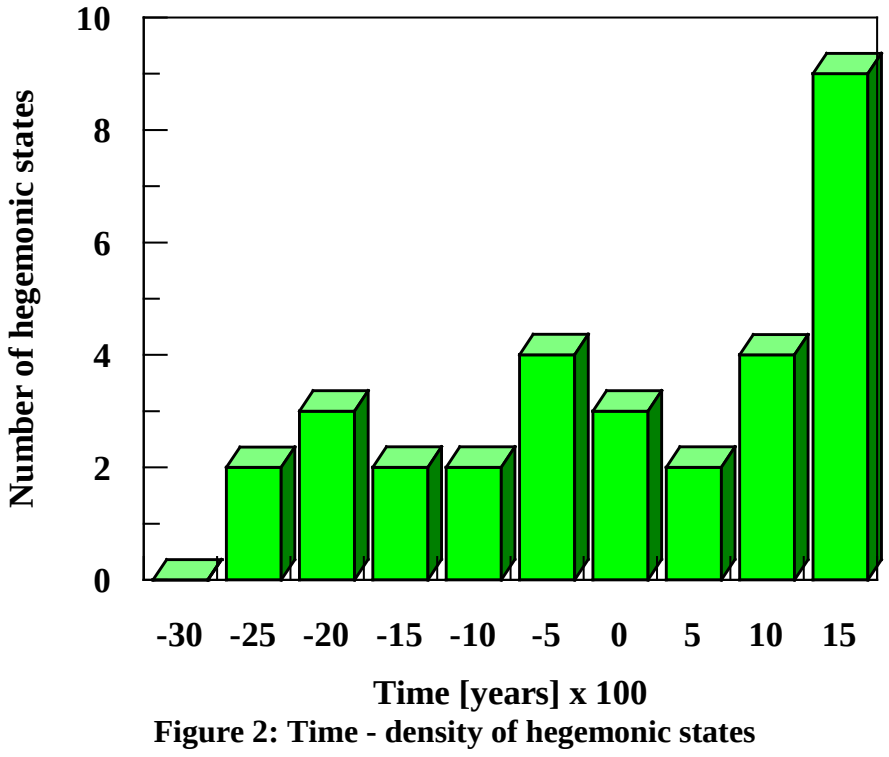

Figure 2: Time - density of hegemonic states

Another representation of the former data (i.e. as temporal series) is shown in Figure 3, in which the evolution periodicity (Figure 5) of the number of hegemonic states (NHS) and the increasing trend (Figure 4) are more evident.

Figure 3: A time series of hegemonic states evolution

The correlation coefficient of the time-series model is 0.733, which is acceptable, considering that, as mentioned above, it is difficult to clearly define temporal "boundaries" of a civilization.

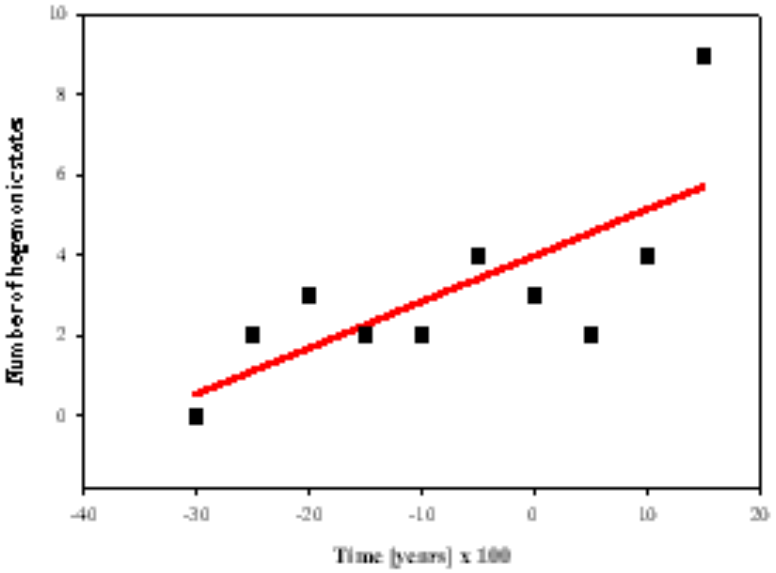

Figure 4: Increasing trend of NHS

The slope of the linear trend is 0.11, but it is corrected by evolution periodicity which imposes for the immediate future a decreasing of the number of universal civilizations.

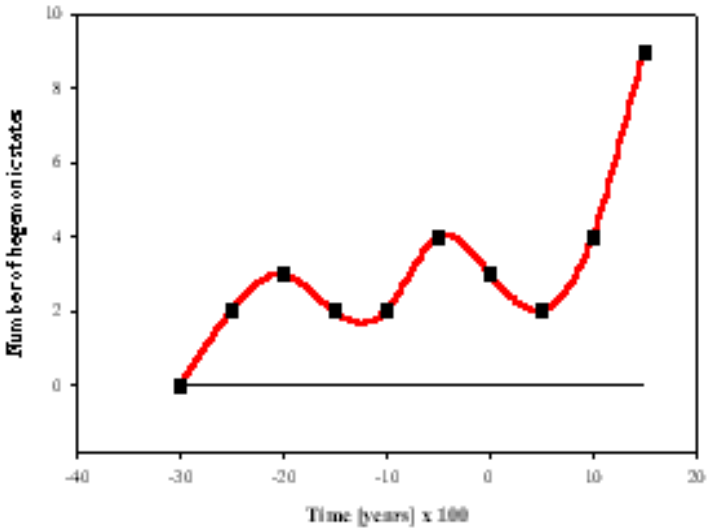

Figure 5: Evolution periodicity of NHS

If the trend is eliminated, the evolution of NHS results as is shown in Figure 6.

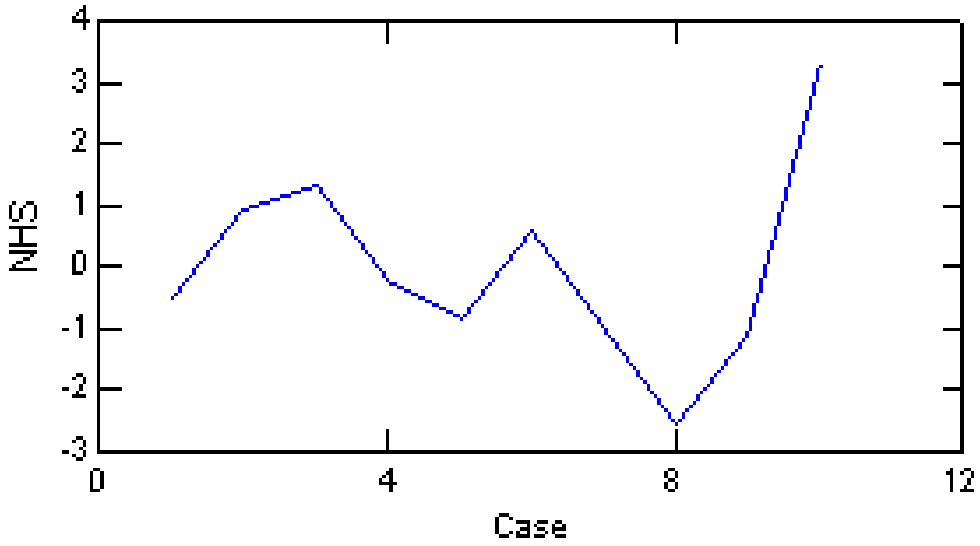

Figure 6.

The time series modeling the evolution of NHS without the increasing trend was identified as being:

$$f = \sin(\frac{2\pi x}{T} + k)$$

where x is the time-variable and T and k are constants with following values: T=29.17 and k = -5.68

Based on this time series, the prediction for the next 500 years-period is the existence of 3 hegemonic states.

Conclusion

The present paper aimed to model by time series means the evolution of the number of hegemonic states in order to predict a future evolution of the geo-political structure.

The assumptions on which the study is based are those made of a historician and sustained by many politicians, so as their theory is modeled by statistical means. Interpretation of the results could be made only following the starting theory.

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