Short-run and long-run ideologies:

Calculating curves for Christianity and Sovietism

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Abstract

The research framework of this study is related to the problem of why and how the population's beliefs born, develop and finally extinct. In previous work, the kinetics of the groups that remain constant in their empire nationalistic ideologies was developed. Now, this research tries to calculate how beliefs diminish until disappearing. Founded in basic historical data of two ideologies, Christianity and Sovietism, the aim of this work is to establish that the populations increase is inversely proportional to the difference between that population and the maximum N_m that could reach, $dN / (N_m - N)$, and the elapsed time $\alpha_1 dt$, where α_1 is a coefficient greater than zero. As an eternal duration is impossible, a decrement factor $N_m \exp(-\alpha_2 t)$ is introduced. This produces a differential equation that can be interpreted mechanically as the initial impulse that pushes and made it works. The conclusion can be desegregated in three parts: first, in terms of formal equations; second, in sociological terms, to say, religious beliefs are more important than political beliefs; and finally, in terms of political change, that is, slow transformations last very much longer than rapid ones.

Keywords: ideologies, beliefs, Christianity, Sovietism, mathematical modeling

1. Introduction

In a previous work (Kittl & Gibert, 2017), there are differential equations for the study of nations that became empires. These ideas are based on the real cases of the Spanish and British Empire. In this paper, we describe the mechanism of the evolution of populations that maintain their ideologies constant or then disappear, applying to the cases of Christianity and Sovietism. In this sense, we use the term "Christianism" to refer to any particular doctrines of Christianity that merge into a political system for the pursuit of worldly power.

As is known, the case of Christianity is long-lasting and, in fact, the influence it exerts on the world population remains constant to this day. In contrary, the case of Sovietism since it had an unusual growth during the twentieth century and disappeared rapidly at least as the official doctrine of the State when the Union of Soviet Socialist Republics (USSR) collapsed in 1991.

Christianity, as an ideology, owes much of its time extension to its religious character. Being a monotheistic Abrahamic religion, it is the continuity of Judaism and in a certain way, a branch of it. Nevertheless, on the contrary, Judaism is a set of beliefs extremely rigid in comparison to Christianity. Christianity evolves from the Greek and Israel traditions of understanding divinity and synthesizes in a personality cult to Jesus of Nazareth, who has a vision of "wisdom for daily life" which includes forgiveness and flexibility, features that permit to expand the doctrine all over the world (MacCulloch, 2010; Das, 2018).

On the contrary, everyday life in a non-religious authoritarian regime and surveillance apparatus does not allow to expand Soviet ideology but to build a subjectivity of self-surveillance (Levina, 2017). Sovietism consisted, according to our definition, in the official political ideology of the USSR. Between 1922 and 1991 it was defined as the Marxist-Leninist Republic and although formally it was a federation of republics, its political and economic system was centralized due to the existence of a single party that establishes the rules and objectives of economic development, political and social. After 300 years of the Romanoff dynasty, it was difficult to move from monarchy to a kind of democracy. The Soviet system resulted in a Stalinist dictatorship, with extreme levels of state intervention and violence, coming back from ancient nurturist orientation of Russian disciplinary culture (Hoffmann, 2017). Paradoxically, the collapse of USSR emerged unintentionally out of the attempts by the Party reformers to rejuvenate the political life of the Soviet system into the framework of Perestroika (Yurchak, 2017). It seemed that democracy was not in Russian DNA.

Instead of the paper focus on mathematical insights, it is worthy to say that there is a deepening discussion inside the topic, which is the connection between beliefs and political structures. There is an argument that even inside of some modern States founded in irreligious doctrines; religion has a role in society. The problem arises when that role does not fulfill its function or fail in the attempt as it is shown in the case of Stalin's policy for spreading the Soviet influence over the entire Balkans and Middle East geography through the Russian Orthodox Church, despite the atheism ideology of USSR (Duah, 2017). According to Smith (2015), there is another strong argument: the Hebrew biblical narrative is structured around the vision of a sacred journey that closely paralleled the secular trajectory of the nation in nationalist mythology. So, those

imbrications between biblical beliefs and nationalist myths were able to reinforce the time extension of Christianity and its impact on the population.

2. Background

As in previous work, the kinetics of the groups that remain constant, as a percentage of the population, in their political or religious ideologies, were developed. Now we will do it with those that diminish until disappearing. The basis is to establish that the increase dN of these populations is inversely proportional to the difference between that population and the maximum N_m that could reach, $dN / (N_m - N)$, and the elapsed time $\alpha_1 dt$, where α_1 is a greater coefficient what zero. As an eternal duration is impossible, a decrement factor $N_m \exp(-\alpha_2 t)$ is introduced. A differential equation is obtained that can be interpreted mechanically as if the initial impulse developed by the system suffers friction that finally leads it to disappear.

If N is the percentage, with respect to the country or group of countries, that professes a political or religious ideology and N_m is the maximum that can reach, the equation can be written:

$$\frac{dN}{N_m - N} = \alpha_1 dt \quad , \quad \alpha_1 > 0 \quad (1.1)$$

Integrating (1.1) is obtained, taking into account the boundary conditions:

$$t = 0, N = 0$$

$$, N = N_m (1 - e^{-\alpha_1 t}) \quad (1.2)$$

$$t = \infty, N = N_m$$

Since the possibility of an ideology or religion remaining unchanged in time is low, you can limit this time by adding $\exp(-\alpha_2 t)$ to N_m in (1.1), where $\alpha_2 > 0$. The boundary conditions are changed because when $t = \infty$, $N = 0$:

$$t = 0, N = 0$$

$$\frac{dN}{e^{-\alpha_2 t} N_m - N} = \alpha_1 dt \quad (1.3)$$

$$t = \infty, N = 0$$

2.1. General differential equation of the problem

To transform the differential equation (1.3) into another one that does not contain $\exp(-\alpha_2 t)$, the (1.3) is derived and the term $\exp(-\alpha_2 t)$ of (1.3) is introduced in the (1.3) derivative. The (1.3) is:

$$N' = \alpha_1 (N_m e^{-\alpha_2 t} - N) \quad (2.1)$$

Deriving (2.1)

$$N'' = -\alpha_1 \alpha_2 N_m e^{-\alpha_2 t} - \alpha_1 N' \quad (2.2)$$

From (2.1) it follows

$$e^{-\alpha_2 t} = \frac{N}{N_m} + \frac{N'}{\alpha_1 N_m} \quad (2.3)$$

That replaced in (2.2) gives

$$N'' + N'(\alpha_1 + \alpha_2) + N\alpha_1\alpha_2 = 0 \quad (2.4)$$

Equation (2.4) has a mechanical simile, you can assimilate N with a spatial coordinate, so N'' would be the acceleration of a unit mass, N' the velocity and $N'(\alpha_1 + \alpha_2)$ the friction that tends to slow the mass, while $N\alpha_1\alpha_2$ is a restoring force. So the equilibrium would occur when there is no restoring force, ie $\alpha_1\alpha_2 = 0$ or $\alpha_2 = 0$. Equation (2.4) becomes

$$N'' + N'\alpha_1 = 0 \quad (2.5)$$

The solution of (2.5) is

$$N = N_m(1 - e^{-\alpha_1 t}) \quad (2.6)$$

That is, the equation that we already obtained before. If $N'' = 0$ means that there is no acceleration, then (2.4) gives $N = 0$, with the boundary conditions of (1.2).

3. General solution of the equation that describes the evolution of population's ideologies

The general solution of (2.4) is $N = A \exp(\lambda t)$, where A and λ are constants. Replacing in (2.4)

$$\lambda^2 + \lambda(\alpha_1 + \alpha_2) + \alpha_1\alpha_2 = 0 \quad (3.1)$$

The (3.1) has two solutions

$$\begin{pmatrix} \lambda_1 \\ \lambda_2 \end{pmatrix} = -\frac{\alpha_1 + \alpha_2}{2} \pm \sqrt{\frac{(\alpha_1 + \alpha_2)^2}{4} - \alpha_1\alpha_2} = \begin{pmatrix} -\alpha_1 \\ -\alpha_2 \end{pmatrix} \quad (3.2)$$

With the boundary conditions, the solutions are

$$N = Ae^{-\alpha_1 t} + Be^{-\alpha_2 t} \quad (3.3)$$

$$t = 0, N = 0, N' = N_0'$$

B is a constant and N_0' is the initial impulse, be it a political or religious idea, which takes strength in the population, deriving (3.3)

$$N' = -\alpha_1 Ae^{-\alpha_1 t} - \alpha_2 Be^{-\alpha_2 t} \quad (3.4)$$

Introducing environmental conditions by (3.3)

$$\begin{cases} 0 = A + B \\ N_0' = -\alpha_1 A - \alpha_2 B \end{cases}, \begin{cases} A = \frac{N_0'}{\alpha_2 - \alpha_1} \\ B = \frac{N_0'}{\alpha_1 - \alpha_2} \end{cases} \quad (3.5)$$

That introduced (3.5) in (3.3) gives

$$N = \frac{N_0'}{\alpha_1 - \alpha_2} (-e^{-\alpha_1 t} + e^{-\alpha_2 t}) \quad (3.6)$$

$$= \frac{N_0'}{\alpha_1 - \alpha_2} e^{-\alpha_2 t} [1 - e^{-(\alpha_1 - \alpha_2)t}]$$

We suppose $\alpha_2 \ll 1$ then (3.6) transforms, if we also suppose $\alpha_2 = 0$ and taking into account (1.2), in

$$N = \frac{N_0'}{\alpha_1} (1 - e^{-\alpha_1 t}) = N_m (1 - e^{-\alpha_1 t}) \quad (3.7)$$

As well

$$N = N_m e^{-\alpha_2 t} (1 - e^{-\alpha_1 t}) \quad (3.8)$$

Knowing that $0 < \alpha_2 \ll 1$ and $(N_0' / \alpha_1) = N_m$, deduced from (2.1). It can be recovered (1.3) by obtaining $\exp(-\alpha_1 t)$ from (3.6)

$$e^{-\alpha_1 t} = -\frac{\alpha_1 - \alpha_2}{\alpha_1 N_m} N + e^{-\alpha_2 t} , \quad (3.9)$$

further

$$N' = \frac{\alpha_1 N_m}{\alpha_1 - \alpha_2} (\alpha_1 e^{-\alpha_1 t} - \alpha_2 e^{-\alpha_2 t}) , \quad (3.10)$$

Replacing (3.9) in (3.10)

$$N' = \frac{dN}{dt} = (N_m e^{-\alpha_2 t} - N) \alpha_1 , \quad (3.8)$$

it is (1.3)

4. Obtaining the parameters and examples of some specific cases

For these calculations we assume $0 < \alpha_1 < 1$ with the boundary conditions (1.3) and (2.1)

$N_0' = N'(t = 0) = \alpha_1 N_m$ if we assume $N_0' = N_m / t_i$, being t_i the time necessary to

organize the basis of a religion or an ideology, you have

$$N_0' = \frac{N_m}{t_i} = \alpha_1 N_m, \alpha_1 = \frac{1}{t_i} \quad (4.1)$$

According to (3.6)

$$N'(t = t_m) = 0 = \frac{N_0'}{\alpha_1 - \alpha_2} (\alpha_1 e^{-\alpha_1 t_m} - \alpha_2 e^{-\alpha_2 t_m}) \quad (4.2)$$

Where t_m is the time when the function reaches its maximum $N' = 0$ and taking into

account $\alpha_2 \ll \alpha_1$ so $\exp(-\alpha_2 t_m) = 1$

$$\alpha_1 e^{-\alpha_1 t_m} - \alpha_2 = 0 \quad (4.3)$$

Thus

$$\alpha_2 = \frac{\alpha_1}{e^{\alpha_1 t_m}} = \frac{1}{t_i e^{\frac{t_m}{t_i}}} \quad (4.4)$$

So if we know t_i and t_m , the organization time and the time when a maximum expansion

is reached, the parameters α_1 and α_2 are obtained as

$$\alpha_1 = \frac{1}{t_i}, \alpha_2 = \frac{1}{t_i e^{\frac{t_m}{t_i}}} \quad (4.5)$$

The time in which decay or time begins in which N has its inflection is

$$N'' = \frac{N'_0}{\alpha_1 - \alpha_2} (-\alpha_1^2 e^{-\alpha_1 t_{in}} + \alpha_2^2 e^{-\alpha_2 t_{in}}) = 0 \quad (4.6)$$

Thus

$$t_{in} = \frac{2}{\alpha_1} \text{Ln} \left(\frac{\alpha_1}{\alpha_2} \right) = 2t_i \text{Ln} \left(e^{\frac{t_m}{t_i}} \right) = 2t_m \quad (4.7)$$

The time $t_{1/2}$ in which N reaches half of its maximum value N_m is

$$N = \frac{N_m \alpha_1}{\alpha_1 - \alpha_2} (-e^{-\alpha_1 t} + e^{-\alpha_2 t}) = \frac{1}{2} N_m \quad (4.8)$$

How $\alpha_2 \ll \alpha_1$

$$\frac{1}{2} = e^{-\alpha_2 t_{1/2}} [(1 + e^{(-\alpha_1 + \alpha_2) t_{1/2}})] \quad (4.9)$$

Therefore as $\exp [(-\alpha_1 + \alpha_2) t_{1/2}] \approx 0$, we have

$$t_{1/2} = \frac{\ln 2}{\alpha_2} = t_i e^{t_m/t_i} \ln 2 \quad (4.10)$$

With (4.1), (4.5), (4.7) and (4.10) it is fully characterized N . In the case of the Christian Church we take $t_i = 300$ years, $t_m = 1200$ years, $N_m = 1$, $t_{in} = 2,400$ years, $N_{in} = 0.864$, $t_{1/2} = 11,350$ years and $t_f = 8,200$ years (Figure 1).

Figure 1: Christianity evolution

On the other hand, soviet Communism $t_i = 3$ years, $t_m = 9$ years, $N_m = 1$, $t_{in} = 18$ years, $t_1 / 2 = 42$ years and $t_f = 58$ years. (Fig. 2)

Figure 2: Sovietism evolution

An overview can be obtained if we make $t_i = 1$, and curves are drawn for $t_m = 2, 3, 4, \dots$

For any other case with t_i / t_m different from the plotted cases, the new curve will be between $n < t_i / t_m < n + 1$, and a general overview of the phenomenon will be obtained.

Figure 3: The general case

In figure 3, curves $N = N(t)$ as a function of t_i / t_m , $t_i = 1$ organization time, t_m time it reaches the maximum, time at which decay begins, $t_m = 2t$. The parameters are indicated $t_i / t_m = 1/2, 1/3$ and $1/4$, $t_f = 8.5, 14.2$ and 20 in arbitrary units time.

5.-Conclusion

There are religions that have completely disappeared, such as the religious-political system of Egypt and both Greek and Roman religions. Political systems such as the monarchy practically disappeared, like the communist system. There are religions that have a lot of antiquity like the Judaic (4000 years?), The Mohammedan (1300 years), the Buddhist, etc. Other political systems have some antiquity, such as representative democracy over 100 years. Representing these processes with an equation like (2.4), which has an interpretation that is fully adapted, is more than interesting.

This equation tells us that at the beginning the process is an indefinite linear growth, immediately begins to be delayed and then decreases until it reaches zero, after an infinite time. The beginning corresponds to an original impulse that, by the law of

inertia, would be maintained indefinitely, but it is retarded what corresponds to friction and gradually it is annulled because there is a restoring force. This last interpretation corresponds to a material point obeying the laws of dynamics. But these three tendencies are manifested from the beginning: indefinite growth, diminished by friction and a restoring force. It means that from the beginning the development of the political or religious idea is determined. Thus, the two main parameters are the time in which the initial impulse is manifested, the time in which a maximum is reached and with those two values the inflection point t_{in} can be determined and the time in which it will reach a value in which the percentage of the population in which the ideology develops reaches half, the other half will have another, or other, political or religious ideologies. This would mean that in its development the ideology would not evolve according to the free will of its population. This also happens, as we obtained in a previous work (2017) studying the development of empires. There we note that this idea is found in Kant (2007 [1784]) and Tolstoi (2007 [1869]). The changes that occur are attributed by Kant to "nature" and Tolstoi to "the need". A discussion about free will and determinism is due to Gibert (2017). It also seems unlikely that an ideology or religion will last as long as it assumes asymptotic behavior, so if at the point of inflection we draw the tangent to that point, where it cuts the time axis in t_f can be assumed the end of the system. So for the Christian Church, it would be the time of extinction $t_f = 8,000$ years, for Soviet communism $t_f = 58$ years, in the general case $t_{f2} \approx 8.8$, $t_{f3} \approx 14.2$, $t_{f4} \approx 20$, in arbitrary units.

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