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Cliophysics: A scientific analysis of recurrent historical events

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Abstract – Named after Clio, the Greek goddess of history, cliophysics is a daughter (and in a sense an extension) of econophysics. Like econophysics it relies on the methodology of experimental physics. Its purpose is to conduct a scientific analysis of (recurrent) historical events. Such events can be of sociological, political or economic nature. In this last case cliophysics would coincide with econophysics. The main difference between cliophysics and econophysics is that the description of historical events may be qualitative as well as quantitative. For the handling of qualitative accounts cliophysics has developed an approach based on the identification of *patterns*. To detect a pattern the main challenge is to break the "noise barrier". The very existence of patterns is what makes cliophysics possible and ensures its success. Briefly stated, once a pattern is detected, it allows predictions to be made. As the capacity to make successful predictions is the hallmark of any science, it becomes easy to decide whether or not the claim made in the title of the paper is indeed justified. A number of examples of clusters of similar events will be given which should convince readers that historical events can be simplified almost at will very much as in physics. In the last part of the paper, we describe cliophysical investigations conducted over the past decades; they make us confident that cliophysics can be a valuable tool for decision makers. This is not an ordinary physics paper for it does not focus on a specific question but rather delineates a new field and outlines an innovative research program. Neither should it be seen as an opinion paper for, thanks to its nine co-authors, it offers *objective* arguments in support of its proposals.

Introduction. –

Objectives. In this paper we will try to convince our readers that it is possible to analyze *recurrent* historical events scientifically. This approach should be seen as a natural extension of physics and econophysics. Historical phenomena are characterized by high levels of background noise (in a sense defined more precisely later on) but nonetheless it is possible to find regularities and patterns. This is our first objective. Mathematical models may come later. Regularities and patterns give predictions and conjectures that can be tested, which is the distinctive trait of science. We hope that the paper will lead those of our readers who have an interest both in history and in science to try this approach by themselves. A somewhat expanded version of the paper is available in ref. [1].

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Dispelling misunderstandings. From the start we wish to dispell possible sources of misunderstanding.

What distinguishes cliophysics from mere statistical analysis of social events?: The short answer is that the methodology of cliophysics is modeled on the rules of experimental physics. The latter teach us how to *design experiments* in ways which ensure both accuracy and reliability. Having said that, we realize that some additional explanations are needed.

One key requirement of experimental physics is that the investigation should be based on *several* case studies (in fact as many as possible), never on a single one. In a general way, once the data have been generated, the fate of the investigation is sealed. With poor data even sophisticated statistical tools will be of little help. For instance, in order to identify the Higgs boson with certainty, the LHC experiment had to run several additional months in order to generate enough events. Without sufficient high-quality data statistical algorithms cannot give reliable answers.

Similarly, in cliophysics the key challenge is to collect as many (similar) case studies as possible. It must be emphasized that this includes events documented in non-English languages. For instance, Arabic, Chinese, French, Japanese and Korean are the (non-English) languages of the 9 co-authors. This can be done through teamwork, but in recent times notable progress in automatic translation and artificial intelligence has extended access to a host of cross-national historical sources.

Simplicity: The second key rule that cliophysics borrows from experimental physics is the *simplicity* requirement. The 2-body problem was solved before the 3-body problem, the hydrogen atom was investigated prior to heavier elements. These are but two examples among many others. How this simplicity requirement can be worked out in cliophysics will be explained later on.

Earlier studies: the missed opportunity of positivism. The second half of the 19th century was a fertile time for the development of the social sciences particularly in France. It was marked by the triumph of Positivism. In the social sciences Positivism consisted basically in applying the methodology of physics to social phenomena. As an illustration the first name Auguste Comte (1798–1857), the "creator" of sociology, gave to this new field was "social physics". After his death his work was continued by other positivists such as Ernest Renan (1823–1892), Hippolyte Taine (1828–1893) and Emile Durkheim (1858–1917). The "rules of the methodology of sociology" that the latter developed in a book bearing this title [2] are modeled on what we call in the present paper the "spirit of physics". It does not come as a surprise that, stimulated by public interest, positivists also tried to apply the same approach to history. It is in 1894 that Paul Lacombe[1] published a book entitled "Making History into a Science" (French title "De l'histoire considérée comme science"). His objective was excellent yet, instead of following Durkheim's advice to study social phenomena in the same way as natural phenomena, he relied on an anthropomorphic approach based on the psychology of individuals. This led nowhere because ultimately it relied on being able to understand the human brain, a system of much greater complexity than human societies.

Until 1970, with scholars like Marc Bloch, Jean-Paul Sartre, Fernand Braudel or Pierre Chaunu, there were interesting innovations in historiography but the ambitious program set by Paul Lacombe was not revisited. It seems that Positivism had lost its momentum.

What about recent decades? Is there ongoing work on a program starting from simple cases and proceeding to more complicated ones? Not to our knowledge. The work of the "Cliometric Society" (of which one of the co-authors had been a member for many years) has nothing to do with cliophysics. It is mere modeling and statistical analysis. That is why physicists need to revive interest in the objective set by Paul Lacombe more than a century ago.

Are there recurrent events? At first sight the objective of the paper may seem overly ambitious but one should observe that the title does not promise a scientific analysis of history in a general way. It focuses on recurrent events, that is to say historical events which repeat themselves in similar form. It is well known that in science reproductibility is a key requirement. It may be objected that historical episodes never repeat themselves exactly in the same form. But neither do physics experiments. For instance, if one tries the experiment of the Foucault pendulum in Singapore it will fail[2]. In other words, it means that in this experiment the pendulum cannot be considered as a closed system. It is subject to an exogenous factor which cannot be eliminated. Moreover, head-on collisions of protons in an accelerator occur in many different ways. In such cases, in order to ensure reproductibility, large numbers of collisions must be recorded and their outcomes classified into diverse groups of reactions.

The table in fig. 1 shows that in its historical development physics was firstly successful in the study of stable systems in which the background noise is almost nil. The refraction of light, the orbits of planets are stable phenomena subject to little background noise. For such phenomena measurement errors are the only source of variability and this factor can be gradually reduced as measurements become more accurate.

Keyrole of the search for simplicity in physics' successes. All too often the mathematical formalism is seen as the hallmark of physics. This conception has become prevalent particularly since 1900. However, physics also teaches

[1] See `https://en.wikipedia.org/wiki/Paul_Lacombe_(historian)`.

[2] At the North Pole the oscillation plane of the pendulum will be seen to make a full 360 degree rotation in 24 hours, in Europe it would take some 35 hours and in Singapore it would take an infinite length of time, meaning that the oscillation plane will not rotate at all.

Field of physics	Keywords (topics)	Keywords (researchers)
Optics	refraction, rainbow explanation, telescope	Descartes, Galileo, Leeuwenhoek
Astronomy	Kepler's laws, gravitational attraction	Tycho Brahe, Kepler, Newton
Mechanics	pendulum, orbits of planets	Huyghens, Le Verrier,
Thermodynamics	Second principle, ideal gas	Carnot, Clausius, Joule
Statistical mechanics	many particles, entropy	Boltzmann, Maxwell
Hydrodynamics	Reynold's number, turbulence	Reynolds, Prandtle, Navier
Quantum mechanics	energy levels, uncertainty principle	Planck, Heisenberg, de Broglie
Chaotic systems	bifurcation, attractor,	Prigogine, Feigenbaum
Econophysics	stable laws, predictive economics	Pareto, Mandelbrot, Stanley
Cliophysics	recurrent historical events	Work in progress

Notes: The objective of this timeline is to emphasize the critical role of variability and background noise. Variability is of course not the only factor at work but it plays clearly an importent role. In the earliest systems investigated with success there was hardly any background noise (if one excepts the noise due to measurement errors). On the contrary, hydrodynamic systems are affected by turbulence which is a random phenomenon. Note that turbulence should be seen as endogenous noise. Similarly, chaotic systems are inherently unstable and generate their own variability. Moreover, quantum systems are defined in terms of probability which means that any measurement requires a great number of events.

Fig. 1: The development of physics consisted in identifying patterns among increasing levels of noise. The table lists only landmark steps. In cliophysics, there will be substantial background noise. In this respect see also the discussion (given below) of the role of background noise in the classification of diseases.

us important lessons about how to conduct experimental investigations.

The first lesson, namely the reduction of the background noise was already mentioned in the previous subsection.

The second lesson, the simplicity requirement, was also briefly mentioned but it deserves a more detailed explanation. Instead of a ball rolling on a wooden plank, Galileo could have studied the trajectory of cannon projectiles. That would probably have raised the interest of his sponsors, but the attempt would have ended in failure for the obvious reason that this problem is much more difficult.

Is it possible to consider simple cliophysics "experiments"? We think so.

Let us consider the case of a pendulum. This is also a topic in which Galileo was interested. More precisely, he studied the period of a pendulum that is now called a simple pendulum. It is a pendulum which moves in a steady vertical plane. However, a spherical pendulum has at least half a dozen different movements: the Puiseux effect, the Foucault effect, the added mass effect, and so on. If all these movements are allowed to occur simultaneously, the movement becomes complicated to the point of defying any modeling attempt. How could physicists overcome this obstacle? The answer is simple.

For each of the different effects they designed a specific experiment which eliminated all other effects except the one they wanted to consider.

For instance, to observe the Foucault effect it is well known that one should use a very long pendulum (50 m or more) for otherwise the Puiseux effect will interfere with the Foucault effect and will lead to fairly random measurements.

In the same spirit, to observe the added-mass effect one should use a pendulum which moves in water rather than in air for otherwise the effect will be too small.

Can we use the same approach for social and historical phenomena? We believe so. The challenge is to select events in which the effect that we wish to observe appears most clearly. How to do that will be explained in the next subsections. Firstly, we explain how the background noise can be reduced. Secondly, it will be explained on an example how to generate events which can be defined by only 2 or 3 parameters.

Historical episodes suitable for cliophysical investigation. –

Defining broad classes of events. In former centuries medicine was confronted to a great variety of diseases and its most urgent task was to set up classes of diseases. It was a difficult task that took centuries. The main obstacle came from the fact that whereas influenza patients do not all show the same symptoms, at the same time influenza, pneumonia and covid-19 are characterized by fairly akin symptoms. Therefore, effective treatment relied on accurate observation and sound judgment.

Likewise historians are confronted with a huge variety of events and their first task is to define broad classes of similar cases. Table 1 is a first step in this direction[3]. Only homogeneous sets of similar cases can be analyzed with a chance of success.

[3]In astrophysics catalogs of stars fulfill the same objective. Astrophysicists who want to study binary stars must be able to find their locations in a catalog. Only then can they really start their investigation.

Table 1: Examples of clusters of low noise events.

Event	Number of cases	Example
1 Peasants' revolt	∼300	Wat Tyler revolt, England, 1381
2 Major mushroom strike	∼20	France, May 1968
3 General strike planned by union	∼20	Switzerland, November 1918
4 Rejection riot	∼50	Tulsa, Oklahoma, 1921
5 Protest riot	∼100	Detroit, Michigan 1969
6 Massacre of peaceful demonstrators	∼50	St Petersburg, January 1905
7 Mutiny on land	∼50	Pennsylvania Line mutiny, 1783
8 Mutiny on ship	∼20	Hermione mutiny, Royal Navy ship, 1797
9 Prison riot	∼100	Attica prison, New York State, Sep 1971

Notes: Note the distinction between "mushroom strikes" which are fairly spontaneous movements by grassroot workers (closely analyzed in Roehner and Syme 2002) and general strikes organized by unions. Note also the distinction between rejection and protest riots. The former are aimed against a minority group that is not accepted by the residents. A protest riot is directed against the state. Some riots have a mixed status; for instance, the Gordon riots in London (1780) were anti-Catholic but were also directed against the government (*e.g.*, prisons were attacked and taken over) because it had passed a law which restored to the Catholic minority some of their rights. Several of the events listed above (particularly 2, 3, 4) have been studied in [3]. The number of cases are understood to be at worldwide level but, needless to say, these numbers give merely orders of magnitude.

Overall view. As emphasized above we must focus on episodes with as little background noise as possible. In this section we mention two categories of cases.

– Cases in which similarity in objectives and agents ensures a relative uniformity and low variability. The cases listed in table 1 are of that kind.

  However, when considered across nations and various time periods, the events listed in table 1 involve a sizeable number of parameters. In other words, they are certainly less simple than the free fall experiments performed by Galileo.

– Just in order to show that one can find recurrent events which depend upon even less parameters than those in table 1, we introduce the set of events listed in table 2. We call them extremely simple events; they are of the same degree of simplicity as Galileo's free fall experiments. At first sight they may appear somewhat weird. The important point is that they depend upon only 3 well-defined yes/no parameters. It will be seen that despite their extreme simplicity, it is nevertheless possible to draw some meaningful conclusions from their comparison.

Requirements for extremely simple events. Events well suited for comparative analysis must be as simple as possible (*i.e.*, involve only few parameters) and in addition they should satisfy the following requirements.

– The most important condition is that these events must be well documented in all their aspects for otherwise any comparative analysis would be impossible. This means that they should attract sufficient attention from contemporaries to receive detailed accounts.

– These events should not be limited to a specific country but exist everywhere so as to allow comparison between various countries and time periods.

So far, the only events we have found that conform to these requirements concern the execution of dignitaries. We beg our readers to pardon the recourse to such macabre cases. Actually, there is probably a logic in this, in the sense that it is precisely because such events are gruesome that they impressed contemporaries and were duly recorded. Naturally, that is all the more true when the executed persons are kings, queens or other well-known dignitaries.

Another virtue of this example is to press on the idea that, as was strongly emphasized by sociologist Emile Durkheim [1], we should completely drop our anthropomorphic vision. What matters here is not whether the topic is macabre or not, but whether the cases are simple and well documented.

It is almost certain that historians will find such cases weird and uninteresting but this should not stop us. After all, at the time of Tycho Brahe and Kepler very few people found any interest in their accurate measurements. The field was dominated by astrologers[4] for whom the accuracy of existing astronomical tables was sufficient.

We should completely put aside any anthropocentric attempts to understand human behavior in the way practised by historians. We should perform basic measurements of simple effects. Little by little, through the magic of cross-fertilization, our understanding will expand. At first sight it was not obvious that the study of the refraction of light may help us to understand the rainbow phenomenon, but nevertheless this is what happened.

It is at this point that the role of physicists, and particularly of econophysicists, will be crucial. Now that it is fairly clear that historians will neither approve nor be interested in cliophysics, the only way this field may develop is through the cooperation of physicists; in this term we include physical chemists, astrophysicists and also laymen with a taste for experimental investigation.

[4]It should be remembered that Kepler himself was the official astrologer of the emperor of the Holly Roman Empire.

Table 2: Pattern *vs.* variability in the execution of dignitaries.

Victim	Year	Status	Axe or sword	Head displayed	Head exposed	Hand cut off
Marcus Cicero	−43	Consul of Roman Republic	S	no	yes	yes
Anne Boleyn	1536	Queen	S	?	no	no
Catherine Howard	1542	King's wife	A	?	no	no
Jane Parker	1542	Related to Anne Boleyn	A–S	?	no	no
Mary Stuart	1587	Queen of Scotland	A	yes	no	no
Charles I	1649	King of Britain	A	yes	no	no
Oliver Cromwell	1661	Former Lord Protector	S	yes	yes	yes
Johann Struensee	1772	Count and Prime Minister	A	yes	yes	yes

Notes: From Cicero to Struensee the protocol of the execution was almost identical and served the same objective, namely to destroy a once powerful political leader. Whereas in the case of Oliver Cromwell the objective was also the same, the method was fairly different because in 1661 Cromwell was already dead which means that it was a posthumous execution. His body had to be exhumed from Westminster Abbey. Subsequently to his beheading his body was cut into pieces and his head was displayed on a pole on the roof of Westminster Hall until 1685. In the case of Jane Parker (who was the wife of the brother of Anne Boleyn) the two sources we have found (one in French, the other in English) give conflicting information, hence the A-S mark. "Head displayed" means that the head was shown by the executioner to the public. "Head exposed" means that instead of being buried, the head was displayed in a public place. Thus, Cicero's head and hand were displayed in the Forum. Note that Cicero was not tried but simply blacklisted by his political opponents. Blacklisted persons could be killed by anybody.
Sources: ref. [4] and biographical articles of Wikipedia.

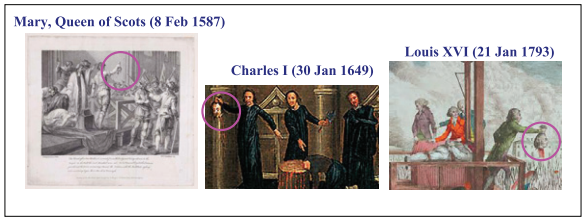

Fig. 2: A key feature in the execution of queens, kings and other high dignitaries was to show their head to the population. Historical records attest that the executioner was specifically instructed to show the head while spelling out the reason of the execution (*e.g.*, "This is the head of a traitor"). Such events are particularly suited for comparative analysis because their close similarity allows us to focus on slight differences.

Protocol of the executions of dignitaries. Table 2 and fig. 2 give several examples of executions of renowned persons. What can the interest of such a list be?

The key point is this.

If considered individually (*i.e.*, without any mention of parallel executions) they do not raise any question and cannot tell us anything of interest. We can just accept each description as a unique event. This makes it impossible to gain any understanding.

In contrast, their comparison brings about several questions.

Many accounts have been devoted to the life of Mary Stuart, Queen of Scots, and her trial during the reign of Queen Elizabeth I. However, little attention has been given to how she was executed.

In the case of Anne Boylen one can mention the following observations.

- Anne Boleyn was the second wife of King Henry VIII. A recently discovered historical record [5] has shown that Henry VIII planned all the details of her beheading. This makes them meaningful.

- If one excludes the dubious case of Jane Parker, Anne Boleyn was the only person in our list who was beheaded with a sword. Some historians argued that among all persons executed during the reign of Henry VIII her case was unique. Clearly this is a point which is difficult to prove because we do not have detailed information about the numerous executions[5] which occurred. At least it can be said that in a sense her execution was set up with "special regard".

More could be said about the table in fig. 1 but we will limit ourselves to only one additional comment. It concerns the case of Count Struensee in Denmark. As Prime Minister he was an adept of the Enlightenment and he was also the lover of the queen. Before being beheaded he had his right hand cut off. Interpreting this as special cruelty would certainly be a misconception for the case of Marcus Cicero shows that this custom also existed in the Roman Republic. It is well known that in the 18th century ancient Rome was still a model. This was particularly true for Roman law and classical architecture.

[5] After the "Pilgrimage of Grace" which was a Catholic uprising, some 200 noblemen were executed.

Fate of vanquished enemies and traitors. Beheading vanquished enemies or traitors has been practised worldwide from ancient times to the 21st century. Many specific historical cases are cited in Roehner (see [6], pp. 56–57). The judicial executions of the dignitaries considered above should be seen as a formalized subset of a much broader tradition. Ignorance of this tradition will lead to the misunderstanding of many historical occurrences. Here are three examples.

- On the South Bank of the London Bridge there is a tower called Bridge Gate which has a flat top. On this place, from 1300 to 1678, there were dozens of heads of traitors (including those of Thomas More and bishop John Fisher) spiked on poles. After 1678 they were moved to Temple Bar. For better preservation the heads were dipped in tar.

- After his victory in Sudan against the Mahdists at the battle of Omdurma (2 September 1898) English Major-General Kitchtener (he would become Lord Kitchener only in 1914) had the body of the Mahdi exhumed and his head sent to Cairo.

- After the Bastille was taken by the people in the early days of the French Revolution[6] the head of governor de Launay was paraded at the top of a pole. Although a familiar image of the Revolution it is not in the least specific to this event. In fact this was a well-established usage. Naturally, historians whose interest is narrowly focused on the Revolution may not know that, and therefore cannot understand the real significance.

Comparative analysis is a source of meaningful interrogations. By capturing the attention this image may distract historians from aspects which were more specific to the Revolution. One of these aspects is the important fact that the insurgants had weapons. As a matter of fact, the main reason for attacking the Bastille was to take the powder and guns that were stored in the fort. This is well attested by the fact that de Launay was asked to deliver the stored weapons and it is only on his refusal that hostilities started.

It is only through comparison with other cases that one comes to realize that it was not common for insurgents to be in possession of guns and even cannons. A comparison with the Gordon riots of June 1780 in London is quite revealing. References [7,8] describe the rioters as being armed with "bludgeons, crowbars and chisels". Nevertheless and quite surprisingly, they were able to take several of the main prisons, *e.g.*, Newgate, Fleet prison, King's Bench prison, New Goal prison. Why did the rioters not attack armuries, naval stores and other places where they would find arms?

[6]The victory was made possible because in the confrontation the troops sided with the insurgents.

The Gordon riot was not an isolated case. The "John Wilkes riot" of the 10th May 1768 saw the gathering of 15000 demonstrators, all unarmed.

In short, neglect of comparative analysis of the kind promoted by cliophysics will result for historians in serious pitfalls: *e.g.*, failure to rightly interpret head spiking or blindness to the fact that the Parisian insurgents were armed (which was mainly due to the fact that the National Guard was on their side).

The case of religious tolerance. In the same line of thought, let us briefly mention another case in which a lack of a comparative perspective led historians, and particularly French historians, to misjudgements. It concerns religious tolerance in France. As one knows, after several decades of civil wars between Catholics and Protestants, in 1588 the Edict of Nantes opened a path of secularism and tolerance. Naturally French Republican historians warmly approved King Henry IV for signing this edict.

However, being focused on France, they did not realize that this edict was an anomaly in Europe. All other European powers (Britain, Germany, Poland, Spain, Sweden) had introduced laws favoring religious uniformity. The mildest of such laws closed access to state employment to members of the religious minority. Many other laws were more severe.

Moreover, in 1618, *i.e.*, three decades after the introduction of the Edict of Nantes, started the "Thirty Years' War" which opposed Catholics and Protestants in Germany and was one of the most destructive European conflicts, at least before the World Wars.

Then, in 1685 the Edict of Fontanebleau revoked the Edict of Nantes. Needless to say, the revocation raised strong disapproval among French historians. Yet, at this time, intolerance was still the most common attitude in all nations; *e.g.*, the Quakers were not allowed into Puritan Massachusetts under the threat of death (at least one Quaker woman was indeed executed).

What we wish to emphasize is that disapproval is an anthropomorphic attitude which leads historians to misjudgements. The best antidote is the comparative perspective promoted by cliophysics.

Testing cliophysical models. – The hallmark of scientific analysis consists in the successful testing of laws. These laws, we will argue here, can be quantitative as is usually the case in physics but can also be qualitative as will often be the case in cliophysics. Qualitative laws state that, under a number of specific conditions, one shall observe a given effect. With quantitative laws, in addition to mere occurences of an effect, one will also be able to predict the magnitude of the effects.

In this section we will explain how comparative analysis naturally leads to qualitative predictions and how such predictions can be tested.

Comparative analysis in cliophysics. The case of zones of influence on the Pacific rim. As an illustration of how this method works we consider the "zone of influence"

effect. This is a case in macro-cliophysics but one which depends on only few parameters. In other words, it is a fairly simple case which is why predictions are possible.

A country A may have a zone of influence Ab in a country B when it has rights in Ab that it does not have in the rest of B. For instance, France had rights in the French concession of Shanghai that it did not have in the rest of China.

In an extension of this meaning, a zone of influence may consist in a whole country. For instance, although formally independent, Egypt was a British zone of influence until the revolutions of 1952.

The degree of influence (d_i) that country A exercises in region Ab is variable on a scale from $d_i = 0\%$ when there is no influence at all to $d_i = 100\%$ in the case of a colony. In the case of Britain one may say that it had a 60% influence in Egypt and a 100% influence in India, at least in the parts of India which were under direct British rule.

On June 2 1954, in a "Security Conference", President Eisenhower declared: "We have got to keep the Pacific as an American lake". What is the implication in terms of degree of influence? Ever since the United States took possession of the West Coast (the conquest of California was in 1847 during the US-Mexican War) it has had an hegemonic position in the Pacific Ocean. As a matter of fact, from 1850 to around 2010 it was by far the most important power of the Pacific rim. Therefore it is quite understandable that in 1954 President Eisenhover could call it an American lake.

In a book by Di *et al.* [9] and in a paper by Baaquie *et al.* [10] the authors determined the American d_i over the Pacific rim and the implication for the future of the relations between China and the United States. US responses to successive encroachments (*e.g.*, by Russia, Japan, the USSR) from 1880 to now were systematically studied. The important point is that during this time interval the US has been unwilling to consider negotiated partnerships preferring to give a free hand to its military[7].

Now, in March 2022 five years have passed since the publication by Di *et al.* and three years since the publication of the related paper by Baaquie *et al.* Although the future is still cloudy recent observations confirmed the fairly pessimistic predictions made in these publications, at least in the sense that no progress was made, nor even attempted, toward a possible compromise. Tension was just allowed to build up.

Additional cliophysical studies. In addition to the studies mentioned above, interested readers will find others in the following articles and books [11–15].

[7]Yet, one can remember that in April 1951 President Truman reined in General McArthur's in his plans against China. In this plan "between 30 and 50 atomic bombs" would have been dropped on China, see the interviews of MacArthur taken in 1954 but which were published in the "New York Times" ten years later on 9 April 1964 (p. 16).

Conclusion and perspectives. – Cliophysics has had a difficult start because its early publications, *e.g.*, the book of 2002, were aimed at historians. With the benefit of hindsight it has become clear that most historians do not accept the approach of cliophysics. At the other end of the spectrum, because (so far) it was expressed in qualitative rather than mathematical terms, cliophysics did not attract the interest of econophysicists or astrophysicists.

Data availability statement: The data that support the findings of this study are available upon reasonable request from the authors.

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