

The Rise and Fall of the Roman Economy: a Quantitative Approach

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Abstract – *The study of Roman economy during either the Republic or the Empire suffers always from a major handicap: the almost total lack of valuable documentation. Thus this leads sometimes to the adoption of mathematical models which in turn deliver highly speculative conclusions. Hence, it is the goal of this work to try to investigate the ancient Roman economy using 3 key indicators: the lead pollution, the epigraphic habit and the demographic evolution.*

Keywords – *demography; epigraphy; household; law; lead.*

1. INTRODUCTION

The study of the ancient Roman economy suffers always from a major drawback: the almost total lack of valuable documentation. For this reason, only a handful of historians ventured to investigate this field and brought important contributions. The first was Theodor Mommsen who in [1] and [2] merely studied the political history and the coinage and less the economical phenomenon, as a whole. But Mommsen has to be credited with the fact that he was the first Roman historian to introduce the systematical study. He was followed by Tenney Frank whose opinion was that Rome's imperialism had as origin its desire to keep the peace in the region and thus to prevent other regional power to rise [3]. The next in the row was Mikhail Ivanovitch Rostovtzeff who thought that the fall of the Roman Empire was caused by an alliance between the army and the so-called rural proletariat during the third century A.D. [4]. Perhaps, his greatest achievement was the successful correlation between archaeology and the ancient literary sources. In the last decades of the twentieth century, these great historians were followed by Keith Hopkins, Bruce W. Frier, and Walter Scheidel. Disregarding these few notable exceptions, unfortunately, in general, no serious attempts have been made to determine the performance level of the ancient Roman economy. That is also because, in the absence of a valid documentation, most of the theories or even mathematical models remain highly speculative, no matter how much attractive they are at first sight.

A first question: does it make any real sense to try to quantify the Roman economy based only on how much did it produce or spend? Or is it better to try to determine the wages and, implicitly, the welfare? To

what extent is it appropriate to do comparisons with modern societies knowing that the population and the labor productivity in Roman times were by far lower than in these modern societies? For instance the population of the Empire, at the height of its economic development was around 60 million inhabitants, more or less like Italy's in present times. So, a first "mathematical" conclusion can be drawn: the economy of the whole Roman empire in the second century of the Christian Era and the welfare of its inhabitants is comparable to that of Italy in 2018. Thus a second common-sense question arises: is this true?

Another *caveat*: the legal framework, the rules of succession in the case of the Roman emperor as well as the basic principles governing the economic entities are very different with respect to the norms of a modern society. Partly because the Roman economy was based on slavery. But not only because of that. In case of many of these rules, the basic concepts are very difficult to be perceived and understood by a person living in our own times.

But if a comparison to our society makes sense only up to a certain point, what is more important historically speaking? An answer to this could be: when the Roman economy began to rise and when to loose its pace. Why is that? Because it can provide important clues also to problems related to the political history of ancient Rome as well as to some economic disparities observed nowadays in Italy and in other regions of what was in the past Roman territory. Thus, it is the purpose of this work to try to establish as objective as possible the approximate moment when Rome began to become a great power and when it became clear that her fate was sealed. In doing this, one shall try to draw some conclusions using hard evidence: the level variation of lead pollution, the distribution of the wrecks and their dating, the demographical evolution and, finally, the epigraphic habit. For a better understanding, one shall

begin with a general study of the legal and economic environment during the first three centuries of the Republic and during the Empire.

2. LEGAL AND ECONOMIC ENVIRONMENT

In the Roman world, the *domus* was the main production and consumption unit at all levels of the society. But there is another word called *familia* which comes also from Latin. Here we have a first important peculiarity with respect to the modern world and a sharp distinction must be made between the two. The term *domus* does not imply only the house itself (as we tend to use it at present) but implies a complicated kinship between a group of people which are related through blood or adoption, this being the *familia*, and the slaves (as well as eventually the freedmen) belonging to the family. Probably, an appropriate translation for the *domus* would be *household*. The functioning of the household was based on monogamy (especially in third century B.C.), but that was not always the case [5].

At the same time, the mortality, especially among men, was rather high. Thus newly married males at the age of approximately 30 had, as one shall see below (see Section 5 about the demographic evolution), a life expectancy of only about 60. This coincided with another phenomenon whose reason must be considered the limited resources: the *sine manu* marriage (which literally means without husband). That is the woman remained under the *tutela* of her father, even after the marriage. The main part of the dowry was represented by land which represented a constant source of income [6]. The dowry value some time between the first century B.C. and the first century A.D. varied between tens of thousands of sesterces (for the curial class) up to one million for the senatorial class [6]. These were the ordinary circumstances. But, there were also situations quite uncommon. For example, what happened to the daughter who had, as we already seen, limited rights, in the case the father was condemned to death before she got married? As it is obvious from the *Senatus Consultum de Pisone patre* discovered in the late 1980s in the former province of Baetica (Spain) and dated 20 A.D., the senate decided to award to Piso's (he was judged for high treason) daughter from her father fortune one million sesterces dowry and other four million as property. The rest was confiscated by the state. Normally, until Augustus (27 B.C.-14 A.D.), after the death of the father, the female received a tutor for supervising the business transactions [6]. This emperor, through the introduction of the *Lex Iulia de Maritandis Ordinibus* (in 18 B.C.) instituted the so-called *ius trium liberorum* meaning that those women who had at least three children, did not need this tutor at all.

As it can be seen, the women had fewer rights in ancient Rome than men. What exactly their impact on the Roman economy was is still a matter of dispute. But, there is a statistic compiled from the epitaphs in

CIL VI, valid only for the city of Rome, based on which we can obtain a basic idea about the workplaces for women. Unfortunately, this statistic has a very general character and is not made for a certain century.

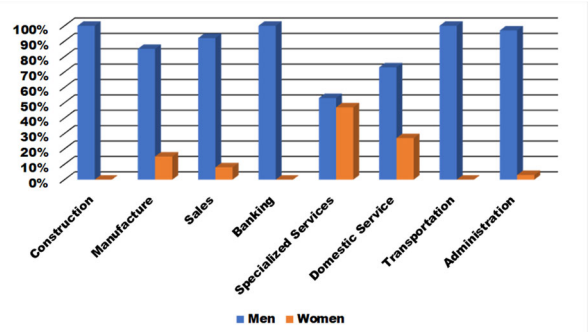


Fig. 1. Workplaces for men and women in ancient Rome [6]

The children had even a more complicated situation. In a society with a high mortality level, the number of orphans was much greater than in our times. Thus, the institution of *tutor impuberum* came to play a key role for maintaining the population within limits. The law related to this type of *tutela* evolved from 200 B.C to 200 A.D extending the guardianship from *impuberes* (children of 14) to *minores* (children of less than 25) [6]. Usually, the *tutor* was chosen from a male relative or by the father, through testament. In exceptional cases, when there was no specific clause in this sense, the tutor was chosen by the *praetor*.

Turning now to economy, it is important to know that the Roman law did not recognize the partnership (*societas*) after the death or withdrawal of one of the partners [6]. The only exception are the *societates of publicani* (very powerful especially during the first century B.C.) which had to collect the taxes from the provinces. So, the Roman state did not award any important support to the private individual for conducting business on a large scale. Another peculiarity are the freedmen and the slaves mentioned above. For a respectable Roman, being involved in business was not at all respectable, according to the moral standards of the time. So they had to use these slaves and freedmen in order to organize and carry out the transactions, as is obvious from various inscriptions. So did also the emperors. Thus many of the freedmen became rich and notorious and even led the state like Narcissus in Claudius time.

We saw how the society was organized at the basic level. But how was organized the *domus Caesaris*?

Practically, the *domus Caesaris* possessed the greatest material resources in the whole Empire. The *princeps* owned vast estates and thus made the procurators in every province take care after his interests. Many times the emperor's interests collided with those of the governors (who possessed their own *domus*) and often these governors came to challenge the emperor's position and actually take his place (especially in the third century A.D.). On the other

hand, the revenues generated by the imperial provinces (that is those administered by the emperor) which were richer than those administered by the Senate, caused the appearance of the so-called *fiscus Caesaris* created by Augustus. With the time, appeared also the *patrimonium principis* which consisted mainly of vast land estates having sometimes as source the confiscations mentioned above. Thus we hear of important edilitary works, like the *Via Traiana* in 109 A.D., about which the ancient authors say that they were built on the emperor's expense. But this is only propaganda. This does not mean literally that the emperor brought money from home for these edilitary works. He, as the principal manager (maybe this is not the most appropriate word but for sure reflects very clear the meaning) of the *fiscus Caesaris* is responsible with the project financing. Practically, the *patrimonium* and the *fiscus* make the *domus Caesaris* the most important and powerful in whole the Empire and place the emperor into position to pay for these great edilitary works "out of his own pocket".

These are the general characteristics of the ancient Roman society for almost seven centuries. Now let's turn our attention to the first performance indicator of the economy: the lead pollution.

3. THE LEAD POLLUTION AND WRECKS DISTRIBUTION

This indicator has been chosen because it is often associated with the plumbing which is further correlated with the urban expansion and hence economic welfare.

Mention should be made of the fact that lead represents a secondary product of the silver mining which, again, is intimately related to the economy since this is the most important metal used in the Roman currency.

Basically, the lead emissions resulted from the mining operations within the Roman Empire (especially Spain) reached Greenland and, finally, they became deposited into the ice of this continent through snowfall.

According to [7], the ice samples have been extracted from a depth of approximately 400 m. Previous studies existed but they used a different methodology in determining the lead concentration in the samples [8]. The newer one consists of the investigation of a sample taken from northern Greenland and for it a continuous analytical system has been implemented [7]. Thus a great number of chemical elements have been detected, not only lead. Between the two methods there is a general correlation, though the newer method is more precise. The correlation takes place despite the fact that the distance between the locations from which the samples have been collected measures almost 300 km [7].

As expected, the lead concentration in the ice samples is dependent on the important events in

political history during both the Republic and the Empire.

But, for the sake of a better understanding, one shall refer to figure 2 and figure 3. In the first, one can see the lead concentration measured in pg/g according to years while in the second one can observe the lead emission in $\mu\text{g}/\text{m}^2/\text{a}$ [7].

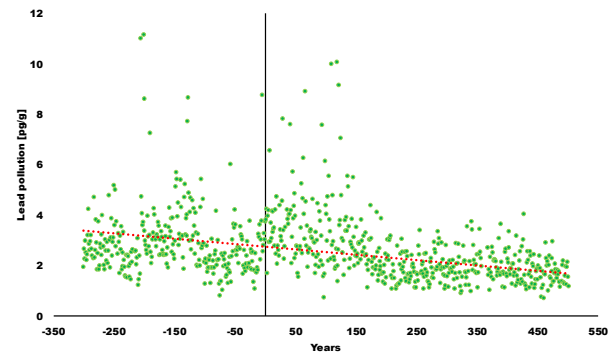


Fig. 2. Lead concentration of the samples

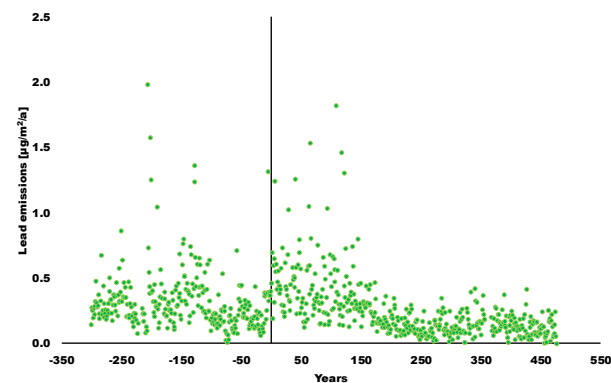


Fig. 3. Lead emissions

Important events related to the lead pollution are the wars like the First (264 B.C.-241 B.C.) and Second Punic Wars (218 B.C. – 201 B.C), the periods of peace like the Pax Romana (approximately 70-192 A.D.) or even random events like the Antonine Plague (approximately 165-180 A.D.).

Now, what can be said about the wrecks and their distribution?

This proxy has been chosen due to the clues it delivers about the economic performance. Unfortunately, there are no recent important works on statistics concerning the ancient Roman shipwrecks.

Since the studies carried out in [8] and [9], nothing essential has been published because on one hand the rhythm of discovery of new wrecks grows exponentially and is valued approximately at 50 in a year [8]. On the other hand, not all the wrecks leave traces on the sea bed and this is the case of ships carrying barrels (made of wood which is perishable) or even other luxury goods like spices which again are expensive and could offer an important clue about the capital which the Romans were willing to invest.

In general, the mass of merchandise carried by such a ship is somewhat below 75 t [8].

In order to have a better idea about the economic power assessed based on wrecks according to century, one should refer to figure 4 and figure 5. In the first, one can observe the number of dated wrecks in the Mediterranean while in the second a similar histogram related to those ships carrying stone [8,9]. This last category is intrinsically related to the great edilitary works and thus to the urban development.

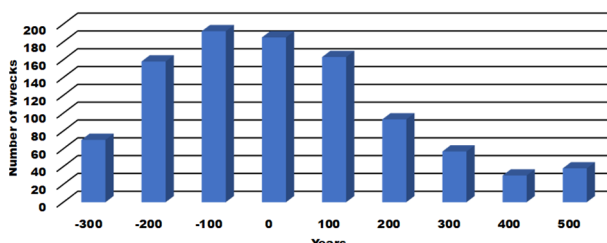


Fig. 4. Approximate representation of the dated wrecks in the Mediterranean [8]

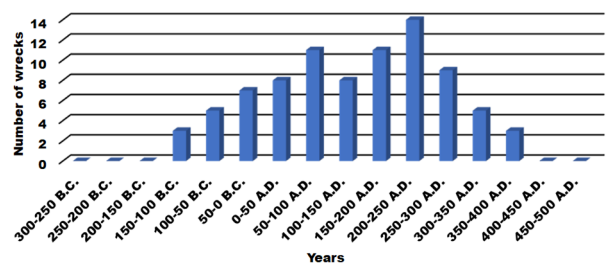


Fig. 5. Approximate representation by century of the number of ships carrying stone [9]

From these graphical representations, one can see that the highest concentration in wrecks is sometime in the second century B.C. while that of the number of stone cargoes is in 200-250 A.D. The first category is basically composed of ships carrying amphoras for oil and wine.

But why these two proxies do not correspond? On one hand, this is given by the type of goods transported. On the other, one must assume that the capital necessary for the edilitary works has been obtained as a result of a longer period of peace in which the military expenditure was low and, hence, a greater part of this capital was invested in this sector.

At the same time, this lack of concordance can be explained also in some other way. The barrels which originated with the Celts must be assumed that were used also by the Romans already in the third and second centuries B.C. For the beginning of the second century A.D. we have as evidence the Trajan’s column in Rome (dated 113 A.D.) which at the beginning of the visual narrative of the Dacian Roman wars describes the organization of the transportation of supplies on the Danube from Moesia Inferior towards Moesia Superior as preparation for the war to come. The ships transporting barrels having left virtually no trace probably could have transformed the distribution in figure 4 to one similar to that in figure 5. But that’s highly speculative.

Related to the stone transportation is the epigraphic habit addressed within the next section.

4. THE EPIGRAPHIC HABIT

Observing the building inscriptions distribution in figure 6 and the stone cargo distribution in figure 5, one can observe that they do not match. This is harder to explain and, unfortunately, again highly speculative. The main idea would be that this type of inscriptions have been reused as construction material during the Late Antiquity and the Middle Ages at a very high rate and what is preserved today does not correspond entirely to the real situation.

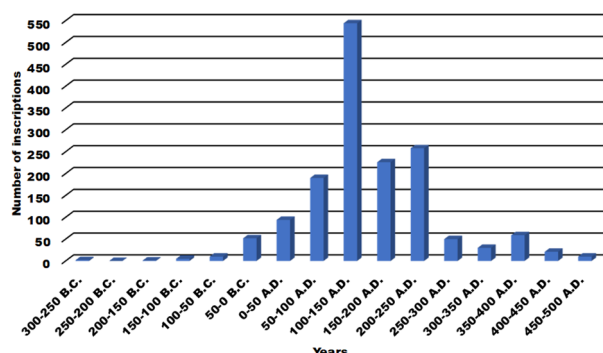


Fig. 6. Building inscription distribution. Source: Epigraphische Datenbank Heidelberg (query run 27 Aug. 2019)

A detailed analysis of this distribution according to monument types is presented in figure 7.

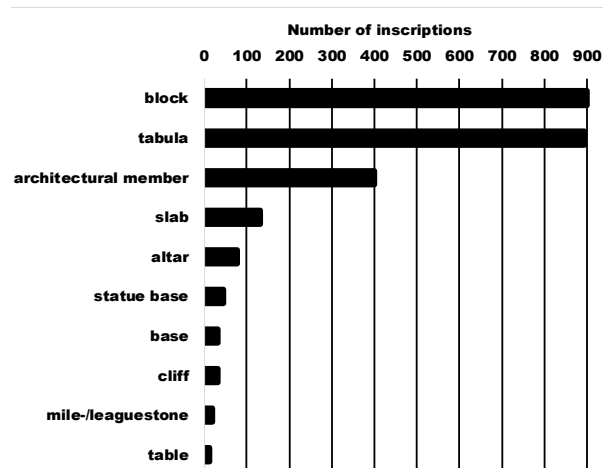


Fig. 7. Distribution according to monument type (top 10). Source: Epigraphische Datenbank Heidelberg (query run 27 Aug. 2019)

Conversely, the distribution based on province is depicted in figure 8. Here, Britannia takes the first place while Rome, somewhat paradoxically, barely reaches only the sixth. Again, the reason must be searched in the extensive reuse of the inscriptions as construction materials during the Late Antiquity and Middle Ages.

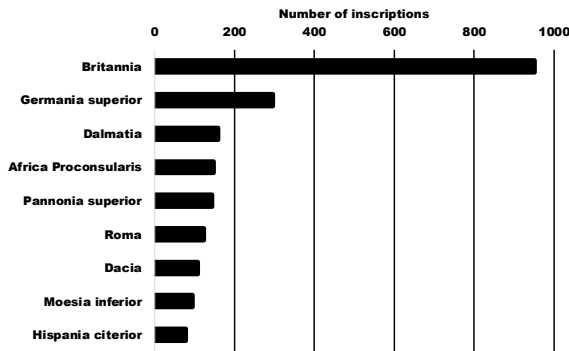


Fig. 8. Distribution according to province (top 10). Source: Epigraphische Datenbank Heidelberg (query run 27 Aug. 2019)

On the other hand, the situation of the provinces like Dacia or Moesia Inferior could be based on something else, namely that they were less developed from economical point of view. Another reason could be the fact that they suffered from the German invasions more than Rome (at least during the third or fourth century AD). This is also the case of Hispania.

The distribution of the honorific inscriptions is presented in figure 9. This is more consistent with the distribution in figure 5.

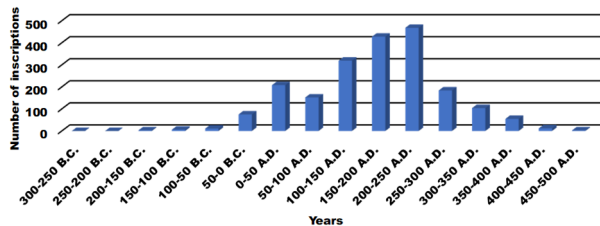


Fig. 9. Distribution of honorific inscriptions. Source: Epigraphische Datenbank Heidelberg (query run 28 Aug. 2019)

The economic welfare generates always a positive evolution in population while the periods of depression have an adverse effect. Thus, the demographic study is addressed within the next section.

5. THE DEMOGRAPHIC EVOLUTION

The methodology adopted here in evaluating the demographic evolution of the Roman empire is the same as in [10]. Thus two principles can be applied: in the first case one can discuss the demography based on the Malthusian cycles which are directly influenced by economy while in the second one can study the mortality, fertility and the migration of the population. Since the actual data needed for the first situation is very scanty, one shall concentrate on the second.

It is assumed that the life expectancy at birth was in average of 25 years [10]. Similar to this, was also the life expectancy in rural China in the 1930s and India in 1911. Practically the mortality rates depicted in Table 1 have been calculated based on the censuses conducted in these two countries [11] given the fact that their population exhibited high mortality rates as well as a high degree of illiteracy, especially within its lower strata. This situation is very similar to that in the

Roman empire. Hence, in [11] a so-called “Model West” has been developed and this was further adopted in [10] also for the Roman empire. In Table 1 [10,11], one can find this model with corrected values.

Unfortunately, this table does not provide the mortality behavior in a certain century, but only in general.

Table 1. The Model “West”, level 3

Age [years]	Males			Females		
	Mortality	Cohort	Life expectancy [years]	Mortality	Cohort	Life expectancy [years]
0	0.3517	100000	22.8	0.3056	100000	25
1	0.2147	64830	34.1	0.2158	69440	34.9
5	0.0563	50911	39	0.0606	54455	40.1
10	0.0404	48045	36.2	0.0474	51155	37.5
15	0.0547	46104	32.6	0.0615	48730	34.2
20	0.0775	43582	29.4	0.0766	45733	31.3
25	0.0868	40204	26.6	0.0857	42230	28.7
30	0.1002	36715	23.9	0.0965	38611	26.1
35	0.1168	33036	21.3	0.1054	34885	23.7
40	0.1397	29177	18.7	0.1123	31208	21.1
45	0.1597	25101	16.4	0.1197	27703	18.5
50	0.1981	21092	14	0.1529	24387	15.6
55	0.2354	16914	11.8	0.1912	20659	13
60	0.3091	12932	9.6	0.2715	16709	10.4
65	0.3921	8935	7.7	0.3484	12172	8.4
70	0.504	5432	6.1	0.4713	7931	6.5
75	0.6495	2694	4.6	0.6081	4193	4.9
80	0.7623	944	3.4	0.7349	1643	3.6
85	0.8814	224	2.4	0.865	436	2.5
90	0.9578	27	1.7	0.9513	59	1.8
95	1	1	1.2	1	3	1.2

The table interpretation is as follows. In the first column, we have age in years. The second contains the mortality while the third, entitled “cohort”, contains the number of persons and is calculated starting from a reference value of 100000. Thus, if one considers the age of 1 for males: 64830=100000-(0.3517 x 100000). The values of the age and mortality rates are imposed by the model type.

The level of the model, on the other hand, is imposed by the life expectancy at birth: in our case 22.8 years for men and 25 years for women [10,11].

There is a hard evidence from antiquity which tends to confirm the validity of this model but not its level. According to it, the level would be 2, meaning a life expectancy at birth for men of 20.4 years and for women of 22.5 years [10]. The preference for the previous model can be explained by the fact that the document proving it dates from Ulpian (c. 170-223 A.D.), being called Ulpian’s life table. But this reflects the reality only for that century. If one takes into consideration the entire history of the empire, level 3 is probably more suited. Ulpian’s document is actually a schedule for the calculation of the tax value of annuities.

Compared to the modern societies where the highest mortality rate is in winter, during the Roman times this reached the peak in late summer and at the beginning of the autumn due to the occurrence of infectious diseases [10].

When discussing fertility, an important aspect must be taken into consideration, an aspect that is almost always forgotten: the slavery. Was there any difference in fertility between slave and free women?

The statistics regarding the slaves are virtually lacking also because the Roman law did not offer

official recognition to slave unions [10]. On the other hand, because the children of a slave woman were also slaves and because the slave revolts against their masters especially in first century B.C. and A.D. were very common, there is a good chance that this social category was sometimes kept within limits artificially by the masters. Maybe not since the beginning but at least at some point in time, during the empire. On the other hand, we do not hear anymore about slave revolts starting with the second century A.D.

So, according to [10] the statistics tend to show that in principle the slave fertility was more or less the same as that of all the free women but for sure below that of free married women.

As far as the migration is concerned, it is important to know that initially this was the main instrument for the empire expansion through military colonization above all. This was valid since Rome's expansion in Italy and reached a climax during the first century A.D. until the beginning of the second. Generally, the forced colonization of the veterans in various areas, other than those in which they had the active service was disliked. Beginning with Hadrian, the program stopped and the veterans were colonized the areas in which they served [10]. As a rule, the military colonization is linked to the urban development.

Another source for migration was represented by the movement of the intelligentsia from East to West (the physician Galen being a well known example) but this type of movement did not matter much.

A third source was represented by the slaves resulted from the defeated people in military campaigns. For instance, half a million slaves resulted from Trajan's Dacian wars [10] while the Jewish revolt in 70 A.D. provided almost one hundred thousand. This source was probably the most important because it represented capital. On one hand it could be sold at the market, on the other, after the selling, it continued to generate income for their masters.

6. CONCLUSIONS

Coming back to the problem mentioned in the title: when began the ancient Roman economy to rise and when was its fate sealed? And when did it reach the peak?

A clear unequivocal answer to these three questions cannot be given. Based on the hard evidence presented previously, the rise started some time around the second century B.C. The peak was reached not necessarily at the same time with the greatest territorial expansion but as a result of a long period of peace, around 150-250 A.D. This can be documented in figures 5 and 6.

The downfall seems to have taken place some time around 350 A.D., yet the Western empire lasted for another 126 years.

But the exceptions from this general rule are the most interesting and sometimes bizarre. For instance, Byzantium backed twice the looser in a civil war (that is Pescennius Niger and Licinius) and, first time was even demolished by Severus as a punishment. Despite this, it managed to become the capital of the Eastern empire, under Constantine, and thus to recover quickly.

And, now the last question: what future research directions should a new paper on this subject address?

Probably, the study of importation of luxury goods and metal hoarding. Why? Because they are antagonist. Put it simple, one can consider that Rome's downfall might have been caused by the draining of capital necessary to pay the frontier army, bribe the barbarous chieftains not to attack Roman territory and, above all, to provide for more sophisticated pleasures many times from distant territories like India and China. Unfortunately, these did not leave too many traces but mentions are made occasionally by various ancient writers like Pliny. On the other hand, hoarding represents just the opposite. The basic idea is that the capital draining was much greater than its hoarding.

So, it is clear that an optimum has not been reached and this contributed to the fall of the Western empire in 476 A.D.

REFERENCES

1. T. Mommsen. *Die Römische Geschichte*. Berlin: Weidmannsche Buchhandlung, 1854-1885.
2. T. Mommsen. *Die Geschichte des römischen Münzwesens*. Berlin: Weidmannsche Buchhandlung, 1860.
3. T. Frank. *An Economic History of Rome*. Lancaster, PA: Johns Hopkins University Press, 1920.
4. M. I. Rostovtzeff. *The Social and Economic History of the Roman Empire*. Oxford: The Clarendon Press, 1926.
5. M. Goodman, "Babatha's Story," *Journal of Roman Studies*, vol. 81, pp. 169-175, 1991.
6. W. Scheidel, I. Morris, and R. P. Saller, Eds., *The Cambridge Economic History of the Greco-Roman World*. Cambridge: Cambridge University Press, 2007.
7. J. R. McConnell, A. I. Wilson, A. Stohl, M. M. Arienzo,
8. N. J. Chellman, S. Eckhardt, E. M. Thompson, A. M. Pollard,
9. and J. P. Steffensen, "Lead pollution recorded in Greenland ice indicates European emissions tracked plagues, wars, & imperial expansion during antiquity," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 22, pp. 5726-5731, 2018.
11. F. de Callatay, "The Graeco-Roman economy in the super long-run: lead, copper, and shipwrecks," *Journal of Roman Archaeology*, vol. 18, pp. 361-372, 2005.
13. A. Wilson, "Indicators for Roman economic growth: a response to Walter Scheidel," *Journal of Roman Archaeology*, vol. 22, pp. 71-82, 2009.
15. B. W. Frier, "Demography," in *The Cambridge Ancient History*, 2nd ed., vol. 11, A. K. Bowman, P. Garnsey, and D. Rathbone, Eds. Cambridge: Cambridge University Press, 2000, pp. 787-816.
16. A.J. Coale, and P. Demeny. (1983) *Regional Model Life Tables and Stable Populations*. New York: Academic Press, 1983.

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