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QUANTIFYING ROMAN IMPERIAL COINAGE

1. *Introduction*

We all love certainties in life and it is unfortunate for those of us who study the history of Greece and Rome that reliable historical sources on the economy are rare and extremely incomplete, especially on the revenues of Rome or the budget of the Roman empire.¹ Moses Finley warned us that we should stop using “the anecdotal technique of dredging up an example or two, as if that constituted proof”.² So today we try to reconstruct the past, even the GDP (Gross Domestic Product) of the Roman Empire, by using complicated formulas or extrapolations based on other extrapolations, etc. Once an idea is expressed in actual figures the data seem much more relevant or tangible. But this is a real danger. The more complex a mathematical formula, the greater the danger of losing sight of the data on which the calculations were based and the greater the temptation of accepting the results as facts. My main research is on coin finds and in 1964 Alison Ravetz produced a very influential paper on the interpretation of coin finds from sites.³ She developed a simple formula replacing the actual number of excavated coins by an index figure taking into account the actual time a certain coinage was struck multiplied by 1000. In fact those index figures behaved just like ordinary percentages and were very useful for drawing diagrams for each site, but several numismatists overlooked this and started comparing the isolated index figures of a reign with those of other sites occupied for 100 years and with others that existed for 400 years, forgetting that you cannot compare series of unequal length.⁴

¹ The author would like to thank all who commented upon this contribution in Rome, and give special thanks to Raf Van Laere (Société belge de Numismatique), Koen Verboven (Ghent University) and Helen Wang (British Museum).

² Finley 1985, 25.

³ Ravetz 1964.

⁴ On the Ravetz-formula see my comments (in Dutch): van Heesch 1998, 23-29.

In this paper I will not try to demonstrate that “nothing can be done”, nor will my tone be a triumphal one. I merely want to ask the questions: What is it that we want to know? Which data are available for quantification? Finally I will enlarge upon the difficulties of quantifying Roman imperial coinage. In this way, my contribution is not the result of detailed research, but a reflection on quantitative research – in a broad sense – of Roman imperial coinage.⁵

2. What are our objectives?

What are our objectives? Historians of the ancient economy, archaeologists and numismatists do not always have the same expectations and often they are interested in completely different matters. Some will be interested especially in generating models for the Roman economy, others will want to clarify issues that are time- or place-specific and then explain them in a more traditional descriptive way.

Roman coins survive in huge numbers and are very suitable for quantifiable research, not only in order to establish the volume of coin production but also in many other ways. Some might want to know how many coins of each type were struck. This is not only because they are curious, but also because it allows them an insight in the minting policy of an emperor, the importance attached to a certain series, or the organisation of the minting process. They will try to establish a relationship between the data and the economic or political use of the coins, all in the hope of reconstructing certain aspects of the monetary, financial, economic, and political history of Rome.

Others will want to know how to interpret the thousands of coins found during excavations all over the Roman world and try to explain “monetisation”, growth, interregional relations or economic integration, etc. Why are coins from a certain reign so plentiful and others almost lacking? How should we interpret a general decline in coin finds or the absence or presence of coin hoards? Although much has been written about the number of coins struck from a single die, it is just one aspect of the overwhelming amount of literature about how to interpret coin finds. In a fascinating booklet with just a few pages of text but huge quantities of tables, Richard Reece tried out several methods on the same body of data in order to let the figures speak for themselves. It illustrates well this never ending quest for ‘the’ right method of interpretation.⁶

Archaeologists and historians will want to compare this data with other

⁵ See also the recently published book edited by Bowman & Wilson 2009.

⁶ Reece 1991.

quantifiable data, such as potsherds, inscriptions, price levels in Egypt, number of ship wrecks, datable wood samples, the length of skeletons, lead pollution in Greenland etc. Without a doubt, it is the comparison of all this measurable data that will shed new light on the rate and volume of economic growth or decline in the empire.

Which question or research topic is the most important one? Possibly the one that attracts the largest audience or the largest number of researchers, but we should not forget that the exploitation of numismatic data can only be safely done after long and painstaking research by the specialist numismatists who identify coins from hoards, excavations and public collections, study dies, try to attribute coins to mints and propose reliable dating.

3. *Quantification: available data*

Is it possible to quantify the coin production of the Roman empire and what data can we work with? Quantifying the volume of coin production has always been a major concern of numismatists but this is not the place to give an overview of colloquia or books dedicated to that subject.⁷

Coin Frequency. When Théodore Mionnet published his *Description de Médailles antiques* in 1806 he used ten degrees of rarity for his catalogue. Fifty years later, Henri Cohen, in his *Description historique des monnaies frappées sous l'empire romain* used the actual commercial value to give an idea of the frequency of a coin type.⁸ The authors of *Roman Imperial Coinage* published between 1927 and 2007 also indicate the relative rarity of each type (six categories in the most recent volume). Although this data was mainly meant for collectors and dealers, it also gave some sense of the importance of a coin issue.

A more scientific approach was used by the Austrian numismatic school of Karl Pink followed by British numismatists such as Harold Mattingly, Robert Carson and Philip Hill.⁹ Based on statistics of coin frequency in hoards and public collections, they identified three categories of coin series: “substantive issues” struck in large numbers, “special issues” characterized by rare commemorative coins, and “curiosities” including hybrids and coin forgeries. Owing to a better

⁷ Much information can be gathered in the other contributions to this volume. For comprehensive numismatic bibliographies, see the volumes of *The Survey of Numismatic Research*, edited on the occasion of the International Numismatic Congresses (e. g. Bern 1979, London 1986, Brussels 1991, Berlin 1997, Madrid 2003 and Glasgow 2009).

⁸ Mionnet 1836, xvi; Cohen 1862.

⁹ Pink 1933; Mattingly 1939; Carson 1962 and Hill 1970.

<i>Issue 8 – AD 227 PM TRP VI COS II PP</i>	<i>Number of coins</i>
<i>Aequitas</i>	<i>161</i>
<i>Pax</i>	<i>170</i>
<i>Emperor</i>	<i>170</i>
<i>Mars</i>	<i>48</i>
<i>Annona</i>	<i>32</i>
<i>Issue 9 – AD 228 PM TRP VII COS II PP</i>	
<i>Aequitas</i>	<i>13</i>
<i>Pax</i>	<i>25</i>
<i>Emperor</i>	<i>26</i>
<i>Mars</i>	<i>29</i>

Table 1. - *Issues 8 and 9 of denarii of Severus Alexander struck in AD 227.*

sequence of the coins, so that they could be fully exploited for further historical research.

The following table (Table 1) made by Robert Carson is based on twelve hoards of denarii of Alexander Severus struck in 227. It reveals internal differences of volume per type with a possible indication that the coins for which fewer numbers survive, came at the end of the year 227 as the number of coins in the following issue (AD 228) were also low.¹⁰

Comparable work has been done ever since and I will limit myself to citing the work of Jean Gricourt and Jacqueline Lallemand (1928-1995). From the 1950s and 60s onwards they were able to reconstruct the chronological order of the coin series of most of the Gallic usurpers of the second half of the third century AD (Postumus and his successors) thanks to the systematic study of the hoards (Table 2).¹¹ Apparently unrelated coins could be placed together by comparing their frequency in hoards and find numbers showed how the mint of Cologne, for example, used two workshops, each producing one reverse type throughout the period.¹²

Die counts. In the 1950s systematic die studies were introduced in the study of Roman coinage, a method previously used with great success for Greek coins.¹³ However, the vast quantities of Roman coins that survive meant that for some coinages it would be a daunting task to produce catalogues that identified coins by both type and die. This explains why most of die studies are limited to short reigns

¹⁰ Carson 1962, 44.

¹¹ Gricourt 1958; Lallemand & Thirion 1970.

¹² These views have been confirmed in more recent publications. For the coinage of Victorinus see, for example, Bland 1979, 65-75.

¹³ Naster 1951.

knowledge of the original quantities that were minted, they were able to reconstruct the patterns of coinage, linking together certain series and proposing a more precise dating of, for example, third century coins. Their main concern was not making global estimates of the finances of the Roman Empire or the state budget; but they wanted to classify the numismatic data in such a way as to reveal the original minting

<i>Victorinus</i> <i>Cologne issues: obverse / reverse</i>	<i>Combined number of coins in 20 hoards</i>
1. IMP C PIAV VICTORINVS P F AVG <i>Reverse: FIDES MILITVM</i>	134
<i>Reverse: PAX AVG, V/*</i>	177
2. IMP C VICTORINVS P F AVG <i>Reverse: INVICTVS, *</i>	1,997
<i>Reverse: PAX AVG, V/*</i>	1,824
3. IMP C VICTORINVS P F AVG <i>Reverse: VICTORIA AVG</i>	15
<i>Reverse: VIRTVS AVG, Virtus I.</i>	16
4. IMP C VICTORINVS P F AVG <i>Reverse: SALVS AVG</i>	1,467
<i>Reverse: VIRTVS AVG, Virtus r.</i>	1,349

Table 2. - *Victorinus* (AD 269-271): coin issues and frequency of the types in hoards (Data: Lallemand & Thirion, 1970, 22).

or to coinages of smaller towns in the eastern parts of the empire. Indeed, much useful work has been done. We now have complete die studies of the coinage of Claudius I, of several gold issues of the second century AD, of the Gallic emperors, of the short reigns of Galba, Otho, Nerva, Pacatianus, Regalianus, Laelianus and many others.¹⁴ From these small scale studies extrapolations have been made to obtain data of coin output for longer periods, and sometimes even to calculate the entire monetary stock of the empire.

Just one warning to those who plan to use these data: some catalogues give the impression of completeness, but are in reality only the publication of unfinished research. One such catalogue lists 20 coins and 20 different obverse dies for aurei and denarii of the *Constantiae augusti*-type of Claudius, without addressing a previously published study by von Kaenel which presents 45 coins and 42 different dies.¹⁵ In both samples, however, the ratio of the surviving specimens/dies is so low that no extrapolation with, for example, the Carter-formula can be done as we apparently only have a fraction of the original coin population.¹⁶ Other examples

¹⁴ See von Kaenel 1986 (Claudius I); Beckmann 2000 and Beckmann 2007 (gold of Trajan); Duncan-Jones 1994 (other second century gold issues); Schulte 1984 (Gallic empire); Kraay 1956 (Galba - bronze); Metcalf 1993 (Otho); Szaivert 1978 (Nerva; dissertation); Bland 1993 (Jotapian); Göbl 1970, with regular updates by G. Dembski (Regalianus). For Laelianus, see Gilljam 1982 (with updates published in *Mitteilungen der Österreichischen Numismatischen Gesellschaft*, 27 (3), 1987, 33-36 and 30 (6), 1990, 94-95, also in NC, 1990, 272-273.

¹⁵ Giard 2000. For a more complete catalogue, see von Kaenel 1986.

¹⁶ The Carter-formula is used by numismatists to calculate the original number of dies that were fabricated for a particular coin issue. It is based on the surviving copies and a die count of the reverse dies: see Carter 1983 and the debates about what is/is not possible in de Callataÿ 2006 (collected papers with references to other studies such as those of Th. V. Buttrey).

<i>AD 114</i> <i>Obv. IMP CAES NER</i> <i>TRAIANO OPTIMO AVG</i> <i>GER DAC</i> <i>Rev. PM TR P COS VI PP</i> <i>SPQR</i>	<i>Number</i> <i>of reverse dies</i>	<i>Number</i> <i>of coins</i>	<i>Estimated</i> <i>commercial</i> <i>value in French</i> <i>francs in Cohen 1882</i>
<i>Augusti profectio</i>	1	2	200 (<i>rare</i>)
<i>Fortuna redux</i>	23	109	40
<i>Jupiter conservator</i>	11	38	45
<i>Bonus eventus</i>	14	54	40
<i>Salus augusti</i>	5	36	40
<i>Vota suscepta</i>	2	11	150 (<i>rare</i>)
<i>Providentia</i>	1	5	40
<i>Regna adsignata</i>	3	6	100 (<i>rare</i>)
<i>Sol</i>	1	1	-

Table 3. - *Reverse dies for Trajan's gold coins of AD 114 (data Beckmann 2007; fourth column by van Heesch).*

are much more instructive. The 947 aurei of Trajan studied recently by Beckman yielded a ratio of 4.6 coins for each obverse die.¹⁷ Based on his die count, Beckman was able to demonstrate that production increased considerably in these years; his study also sheds interesting light on the relative importance of different coin types produced in one year (see Table 3) and illustrates the complex system of Roman coinage using changing reverse types and obverse busts throughout a reign. To his numbers I have added a fourth column for the purpose of comparing his data with the commercial value in French francs in 1882, as estimated by Henri Cohen. The results are pretty good!

We could not hope to obtain such detailed data for all of the imperial coinage, and the differences in die counts per type should warn us against simple extrapolation of data! Most of the studies are limited to gold coins because the material is limited and a complete coverage of all imperial coins series is possible. The same kind of research is unthinkable for the large issues of silver and bronze, which survive sometimes in the tens of thousands of coins.

Coin finds (hoards and stray finds). In my view, quantitative research on the coinages of the Roman Empire should not only focus on die counts, but also make more use of hoards and site finds. Of course these cannot be used to calculate the coin production of the Roman state, as most of the finds reflect the loss of small change. But numerous other interesting questions relating to the ancient economy could be formulated. Enormous quantities of coins from most parts of Western Europe have been published; unfortunately, there has been much less from the eastern Mediterranean.

¹⁷ Beckmann 2007.

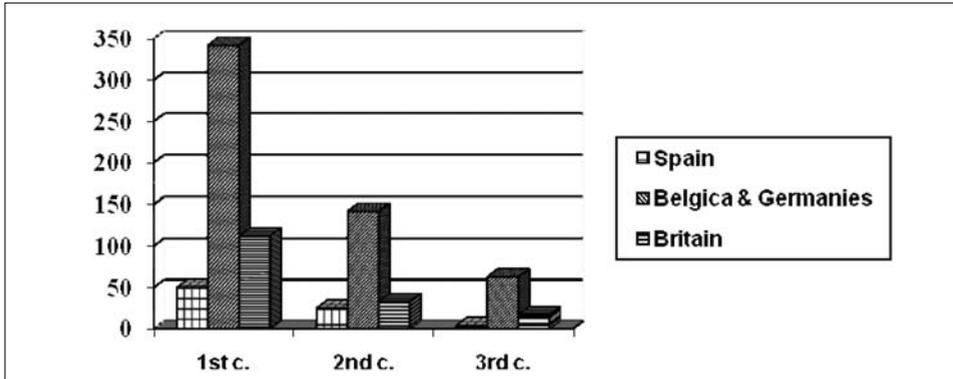


Fig. 1. - Stray finds of Roman gold coins from Spain, Belgica, the Germanies and Britain (based on the data in Brenot and Lorient 1992).

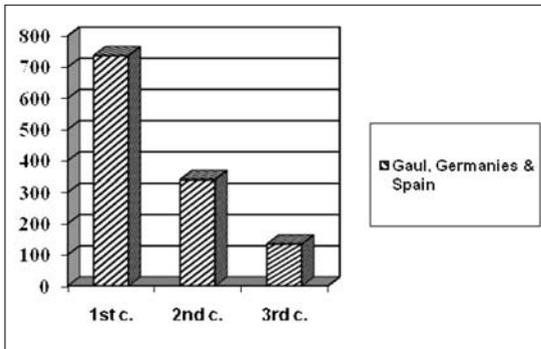


Fig. 2. - Isolated gold coins from Gaul, the Germanies and Spain (actual numbers based on the tables in Brenot & Lorient 1992, 26).

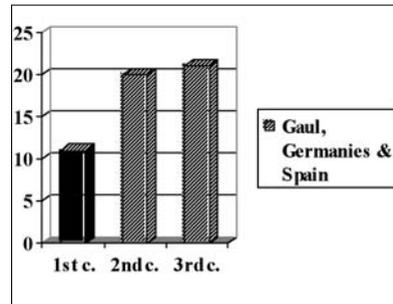


Fig. 3. - Hoards from Gaul, the Germanies and Spain (based on Van Heesch 1998, 90 and 122 note 543, Brenot & Lorient 1992 and only gold hoards containing 4 or more aurei, not mounted in jewellery).

An enormous potential of quantifiable data is already available. Single gold coins of the Germanies, Gaul and Spain were the subject of impressive inventories by Lorient, Callu and others. Gold hoards from all over the empire are also well documented.¹⁸ They were one of the major sources for Richard Duncan-Jones in his *Money and Government* but the subject could still be studied in much more detail and it would be especially promising to see a synthetic study bringing together other archaeological and written sources. The following example is a simplified diagram of part of the available material (Fig. 1). It shows clear differences in actual find numbers between Spain, the Northern provinces and Britain.

¹⁸ Regling 1931 (inventory of gold hoards); Thirion 1972 (supplement to Regling); Callu & Lorient 1990 (single gold finds in the Gauls and the Germanies); Brenot & Lorient 1992 (summary of all the gold finds in the Roman empire, no complete catalogue except for Spain); the lists in Duncan Jones 1994 (all these with references to earlier literature). For Spain, see, for example, Bost, Campo & Gurt 1992.

Interpreting this data together with other archaeological quantifiable data would be a worthwhile exercise. In the second bar chart (fig. 2 and 3) we isolated the finds from all of Gaul, the Germanies and Spain and compared them with the gold hoards (as opposed to single finds) and found that the results were completely opposite.

Continuous debasements and the growing fiduciarity of Roman coinage in the third century AD, provoked a serious crisis of confidence in the Roman silver coin and could explain this pattern of hoarding. But there can be no doubt that much more should and could be done with this material. Of course, diagrams as these can also be misleading. While the growing number of hoards of gold coins might be related to an uncertain economic climate in the third century, the peak in the first century in the diagram of the stray finds can be explained in another way. Nero withdrew most of the earlier gold issues in AD 64 and replaced them with lighter aurei that were struck in huge quantities. In our chart 225 out of the 737 first century aurei are coins of Nero. These coins still dominated the coin circulation in about AD 200. As it is impossible to determine the actual moment of loss of these gold pieces; we should keep in mind that these coins could have been lost between AD 64 and AD 200 or thereabout.

Hoards of more than 10,000 coins are rare but not exceptional and there is a tremendous amount of quantifiable data here to be explored. In a remarkable paper on the third century AD crisis, Depuyrot and Hollard used the data of some 350,000 coins from 65 hoards together with the results of metallurgical analysis to demonstrate how the volume of coinage grew continuously, but also how the silver stock diminished at the same time, throughout the third century AD, probably to be explained by metal loss due to continuous reminting operations, exhaustion of the mines, exports outside the empire and hoarding.¹⁹

They published an interesting table to illustrate this (Table 4). The actual number of coins per reign was replaced by an index figure, starting with Gordian whose total of 13,500 coins were the starting point as 100. By multiplying the figures of column 2 with the weight of silver in each coin (column 3), they obtained an estimate of the relative importance of silver quantities used by the mints of Rome and those in Gaul.

Though it is improbable that the exact output of the mints can be determined by studying single finds from excavations, they too deserve much more attention.

We have published inventories with hundreds of Roman hoards and single finds from all over the Western parts of the empire. Some 300,000 coins from the Germanic provinces are published in the *Fundmünzen* series; 60,000 are catalogued

¹⁹ Depuyrot & Hollard 1987; Hollard 1995. On the monetary policy of systematic withdrawal of good silver coin, see Christol 1977; van Heesch 2002.

Years	Quantity/ year	Grams of silver/coin (& mints)	Silver stock
238-244	100	2.22	222
244-249	84	1.80	151
249-253	88	1.28	113
253-256	131	1.27	166
256-260	132	0.90	120
260-263	316	0.31 (Rome) 0.52 (Gaul)	30 115
263-266	277	0.21 (Rome) 0.53 (Gaul)	32 66
266-268	937	0.10 (Rome) 0.36 (Gaul)	84 34
268-270	841	0.07 (Rome) 0.05 (Gaul)	50 6
270-274	1,376	0.099 (Rome) 0.04 (Gaul)	7 52
274-276	147	0.19	30
276-282	118	0.16	18

Table 4. - *The volume of silver coinage and the stock of silver in the 3rd c. AD: indices (AD 238-244=100) (Source: Depeyrot & Hollard 1987 and Hollard 1995).*

for the Grand Duchy of Luxemburg; 170,000 for Britain and so on.²⁰ All this data is waiting to be explored.

A coin graph from a fairly “normal” site is shown in figure 4.

When compared to other sites from all over North-Western Europe a very similar scheme is revealed (though this is an oversimplification). Coin finds rise under the Flavians and most graphs peak under Hadrian or the Antonines, and coins struck in the third century (except the barbarous radiates from the very end of the century) are much rarer.²¹

Is the third century depression in the coin graph a sign of crisis? If so, can it be linked with similar regressions as seen in graphs of the number of Roman shipwrecks or the one of datable wood remains in Germany (see fig. 5)?²² Are they proof of an economic catastrophe or are our graphs erroneous and misleading, as we know that second century coins circulated throughout the 3rd century and new small

²⁰ Alföldi 1960 onwards (Germany); van der Vin 1993 (Netherlands); Göbl 1976 (Austria); Kos & Šemrov 1988 (Slovenia); Weiller 1972 (Luxemburg); Fitz 1990 (Hungary); Gorini (Italy - Northern); Miškec 2002 (Croatia); Ackermann 1993 (Switzerland). For a detailed survey of existing projects and publications, see Ackermann, Derschka & Mages 2005. For Britain see Reece 1991.

²¹ See for example the tables in Reece 1991 and Doyen 2008.

²² Jongman 2007.

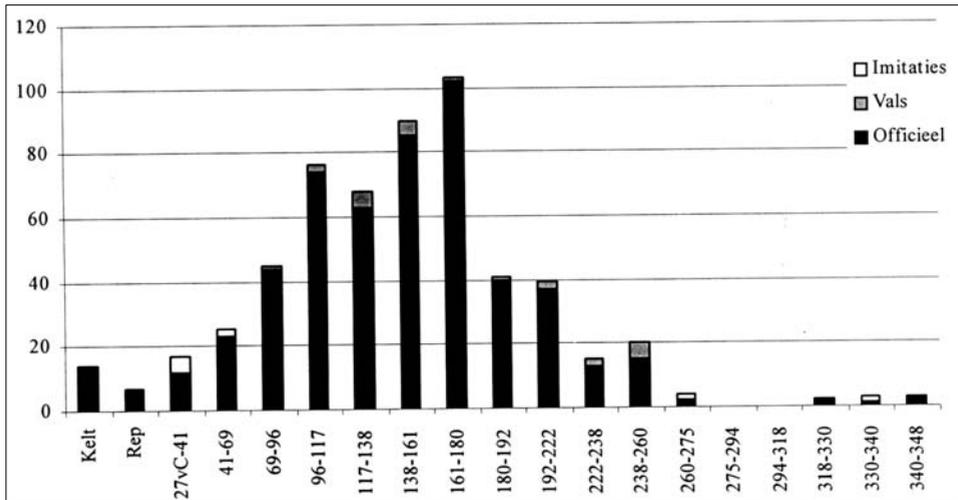


Fig. 4. - Stray finds of Iron Age (Celtic), republican and imperial coins from the Roman settlement (vicus) situated in Pommeroeul (Hainaut, Belgium). The actual find numbers are shown per period or reign (Data: van Heesch 1998).

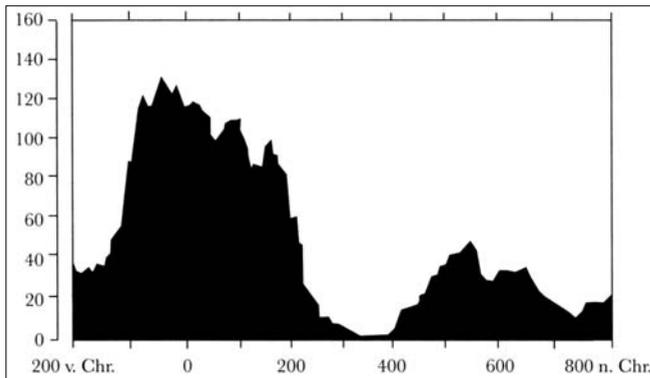


Fig. 5. - Dated wood remains from Roman contexts in western Germany (graph: Jongman 2007).

change did not reach the North of Gaul, as it was replaced by a high value silver coinage that was rarely lost? Of course, this is not the place to discuss these complicated matters in detail but such questions indicate that comparing this data with data from other sources would be a very promising field of research indeed.

Studying such quantifiable data over large areas together with other sources will add to our knowledge and will produce new insights into the economy of the empire. What these examples show, is that besides coin inventories with coin types and die counts, there is other data available that is waiting to be exploited in full.

4. Quantification: a complex matter

Payments in cash only? We can produce graphs to give an idea of periods of heavy minting or coin loss. We can produce a detailed picture of the quality or the deterioration of Roman coinage by analysing the weights and the silver content. We

can also estimate the volume of coin production through die studies, even when absolute numbers are always extrapolations. But our estimates will always be minimal figures, as we will never know how much credit actually added to the quantity of money.²³ For example, soldiers rarely, if ever, received their total pay in cash, and we may suppose that most of it, probably 80%, was deposited in the camp's savings bank.²⁴

Most scholars have limited their research to the second century AD or thereabouts, thereby avoiding a number of obvious pitfalls. Over a 400 year period, the Roman monetary system changed considerably. During the first and the second centuries it seems that not only aurei and denarii were used to pay the soldiers' wages, but heavy minting of bronze in periods without issues of gold and silver would suggest that bronze was also used for these purposes. This was the case in the last decade of Augustus' reign. Bronze was not only coined to provide the market or the soldiers with small change, but could be minted just to economize on precious metals.

In the third century gold payments were more exceptional and silver denarii and, later, antoniniani, became the principal coins. But even the use of a single denomination does not facilitate research, as payments in bullion and precious objects became more frequent. Indeed, they were an essential part of the system in the fourth century AD. The famous Thorigny inscription illustrates this well: Titus Sennius Sollemnis, an officer of high rank in the early third century AD, received not only his wages in gold but also supplementary gifts that were of much greater value than the gold ("*ei salarium militiae in auro aliaque munera longe pluris missit*"): the gifts presented by Tiberius Paulinus, legate of Britain, are detailed in the last part of the inscription: 25,000 sesterterii in gold or possibly 250 aurei, a cloak of Canusium, a robe or dalmatic of Laodicea, a golden brooch with precious stones, two further cloaks, a British rug and a seal skin²⁵. These gifts of precious objects were perhaps only the result of the fact that Sollemnis was *amicus* and *cliens* of Paulinus, but there is reason to believe that this kind of gift-giving was institutionalised from the late third century onwards. Precious objects and ingot-like gold medallions became regular supplements to the ordinary salaries and were distributed on the accession of new emperors, on anniversaries or as rewards. Large gold medallions of Gallienus and Claudius II, as well as a gold *paterna* with a medallion of Gallienus (AD 260) were found in a shipwreck near Corsica. These objects and especially the plate can be compared with the early fourth century

²³ Harris 2006 and Harris 2008 (slightly adapted version of the paper in 2006).

²⁴ Watson 1969, 106-107; van Heesch 2007.

²⁵ For the document and a translation: Pflaum 1948.

silver bowls such as those of Licinius, made in the Roman mint of Nicomedia and Antioch and marked by coin dies in the centre.²⁶

In the fourth century, gold, silver and billon coins were minted in large quantities, but until we know more about the actual value of these coins, expressed in money of account, all estimates will be difficult. The fact that Diocletian could double the value of an *argenteus* from 50 to 100 denarii without changing the alloy, weight and type is quite alarming.²⁷

Old versus new coin. Even if we had a complete record of the production figures of the mint at Rome, we would still have to consider that many of the coins paid out by the government were old coins, received as tax payments or stocked in the treasuries of the provincial *fisci* or the *aerarium* in Rome.²⁸ Old Republican denarii and old Republican asses were put into circulation by the Roman military to cover the soldiers' pay on the Rhine in the early first century AD. Old coin had to be used when the Roman mint was not active. Rome did not strike any gold and silver coin between 12 BC and AD 14 and several other examples of inactivity of the mint are known.

When Hadrian's financial advisors started a massive reminting operation of the Asian *cistophori*, they did not bother to melt down the old coins but simply overstruck them.²⁹ Of the 166 identifiable undertypes 104 or 63% were coins of Augustus and 59 or 36% *cistophori* of Mark Antony which had been in circulation for almost 150 years! The great longevity of Roman coins in circulation can be seen all over the empire and will always complicate matters for those trying to make estimates based on the production of new coin only.

The use of dies. Much has already been written and said about the productivity of ancient dies but it remains a fact that gold is much more malleable than a silver alloy or brass and that these metals behaved differently under the dies. Die output estimates should be used with care for silver and gold as the same dies were often used to mint both gold and silver. But, as with the re-engraving of worn dies, we should perhaps not exaggerate this problem. Of the 450 obverse dies known to Giard for Claudius' gold and silver coins, only four were used for both gold and silver. That is less than 1% and a similar result is obtained for Nero (Claudius: 2/2=4/1; 40/7=41/1; 64/1=65/1; 86/2=87/1; Nero: 16/1=17/2; 25/1=24/1).³⁰

²⁶ Kent and Painter 1977, Bastien 1988, Wiegels 2003 and recently Reinert 2008 (with a contribution from S. Estiot on the third century gold hoard of Lava/Corsica).

²⁷ Erim, Reynolds & Crawford 1971.

²⁸ On these institutions see Alpers 1995 and Wolters 1999.

²⁹ Metcalf 1980.

³⁰ Giard 2000.

Talking about estimates, it is perhaps worth mentioning an interesting case of 2,531 silver antoniani of Valerian I issued in 258, which were all struck with the same obverse die, found in the Eauze hoard in France.³¹ That dies were not used till they were completely worn out is also shown by the surviving imperial aurei that seldom show any sign of wear on the dies. We also know of several cases in which dies were used over several years, and of die links between different reigns.³²

Rome and the provinces. Finally, I should like to raise another point. There is rarely a problem when one wants to investigate coin production of a single mint or a group of mints. But strangely enough, most of our estimates on the quantity of coin or the evolution of coin production in the Roman Empire as a whole, start from the coinage minted in the Roman mints of the west, mainly Lyons and Rome. This, of course, is only part of the story! If we want to have a correct idea of coin production and the monetary economy of the Roman Empire during the Principate, then local, private and provincial coinages have to be included in the research. The authors of RIC (*the Roman Imperial Coinage* catalogues) omitted these series in their volumes, causing many researchers to be misled into believing that all of Rome's coinage could be found in these catalogues.³³

What about the massive local bronze issues in the reign of Claudius I, the coins of the cities, the radiates and other imitations made locally in the third and the fourth centuries?³⁴ When compared to pure gold and silver coinage, perhaps these bronze issues are less important in value, but what about the massive series of silver coins minted in Ephesus, Caesarea in Cappadocia and Antioch in Syria, or the silver or billon of Alexandria in Egypt?³⁵ These, and others, were major mints of the Roman empire and no estimate of the quantity of coin and the economy of the Roman empire, even limited to, say, the second century AD, can be complete without taking these into account. This was clearly understood by David Walker, who wrote an interesting book on Roman metrology.³⁶ His metal analyses are perhaps outdated, but his integrated view of all of Rome's coinage remains unequalled.

Though Rome needed lots of cash in Italy to pay for liberalities, building

³¹ Schaad 1992, 180 and 275; *RIC* Valerianus no. 106.

³² Kraay 1956, 52-53 (Galba-Vitellius-Vespasian); Bastien 1976, 117 (antoniniani); Sutherland 1967, 614 n. 2 (aurei, early fourth century).

³³ Mattingly *et al.* 1923-2007.

³⁴ For a slightly outdated but fairly complete overview of this phenomenon see Boon 1988.

³⁵ See Burnett, Amandry *et al.* 1992-2006 (*RPC*).

³⁶ Walker 1976-1978. Hoards and finds of aurei and denarii are very rare in the Middle East and there can be hardly any doubt that Rome used these so called local coinages to pay its soldiers. Dies of the coinage of Caesarea in Cappadocia were sometimes made in Rome for use in the East, see Metcalf 1996, 83-90.



Fig. 6. - Denarius (reverse legend in Latin) and drachma (reverse legend in Greek) of Pescennius Niger minted in Caesarea in Cappadocia and struck with the same obverse die (Royal Library of Belgium, Coin Cabinet).

projects and so on, I believe that the main transaction in the Roman budget was the pay of its army. Parallels between the minting of huge quantities of tetradrachms in Syria under Vespasian, as well as aurei and denarii struck in the east, closely match the chronology of the war in Judaea.³⁷ However, most of Rome's expenses in the East were paid in locally minted silver coinage and occasionally also in bronze. It is only in exceptional circumstances that we gain more insight into the way Rome used these "eastern provincial coins" that formed an integral part of Rome's coinage. I

will single out just two examples. When Pescennius Niger occupied Caesarea in Cappadocia c. 193 he stopped the minting of drachms and started coining denarii with Latin inscriptions.³⁸ That both coinages were considered as equal to each other is suggested by the die links that are known between Greek inscribed drachms and "ordinary" denarii (Fig. 6). Another example is the well known issue of tetradrachms of Philip I marked *MONETA VRBIS*.³⁹ Metal analysis and style indicate that these were struck in Rome for circulation in Syria, where they are found in hoards.

Roger Bland's unpublished PhD (excerpts published in a recent book on the coinage of Antioch by McAlee)⁴⁰ also contains interesting information on minting activity in the reign of Gordian III (238-244). At that time the antoninianus replaced the denarius in circulation and Latin styled issues of antoniniani were minted in Antioch in rotation with tetradrachms with Greek legends. Both series were important as can be seen in Table 5.

We should not be surprised to discover that mint output in the East differed from the volume of coinage in the West. It is certainly something we have to keep in mind when calculating the coin production of an empire as large as that of Rome. There can be no doubt that this was a completely different world from that of the cities of early Greece. Indeed, I am not convinced that the situation of the Roman empire has many similarities with that of the Hellenistic kingdoms.

³⁷ Burnett, Amandry 1992-2006 (volume II, 1999, 274-275).

³⁸ Van Heesch 1978.

³⁹ Baldus 1969.

⁴⁰ McAlee 2007, 315-319.

<i>Antioch</i>	<i>Series</i>	<i>Date</i>	<i>Obv. dies</i>	<i>Production estimate</i>
<i>Antoniniani</i>	1 st series	238-9	674	20,222,000
<i>Tetradrachms</i>	1 st series	240	205	6,159,000
<i>Tetradrachms</i>	2 nd series	241	12	360,000
<i>Tetradrachms</i>	3 rd series	242-3	98	2,949,000
<i>Antoniniani</i>	2 nd series	242-4	2,279	68,370,000
<i>Total</i>			3,268	98,058,000

Table 5. - *Estimated Coin Production under Gordian III in Antioch (Data: Bland & McAlee 2007).*

5. Conclusions

In short, there can be no doubt that quantitative research on coinage is crucial if we want to interpret our data in a correct way. In this paper I made four points, which I hope will encourage further research.

First, we should accept that numismatists are also interested in the more “technical” aspects of coinage than archaeologists and historians of the ancient economy. Quantification can have other objectives and applications that can contribute significantly to our knowledge of the monetary system: these include the way coins were produced, where and when. However general models or theories, or estimates, covering all of Rome’s empire or covering several centuries, should be studied in collaboration with other researchers who have specialist knowledge of pottery, epigraphy, data from papyri etc. Only close collaboration can avoid pitfalls or over-adventurous interpretation due to insufficient knowledge of the broader material that is available. Second, I believe that a more systematic approach to research on the coin find evidence for the Roman Empire would produce important results as the available quantity of data is enormous and easily comparable with other archaeological data.

Third, no study of the budget of the empire based on the coinages of the western mints of the empire alone can produce reliable information for the entire budget of the Roman Empire. For the time being, our understanding is skewed towards Western Europe.

Fourth, the Roman monetary system developed and changed profoundly in the third and the fourth century and we must acknowledge that each period requires its own appropriate methodology. Finally, I believe that the hard work that goes into making new inventories of coins and catalogues of finds, dies, and so on (not always the most enjoyable of tasks!), will be part of our life for a long time to come, as there are still many missing links.

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