Reform, recognition and reaction: Charting responses to silver coinage reforms through hoarding patterns, 1st-3rd century AD

By

Nathan Murphy

A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy in Classics and Ancient History

University of Warwick, Department of Classics and Ancient History

March 2022

Contents

Acknowledgements

Completion of this thesis would not have been possible without the contributions of many friends and collaborators over the years, of whom there are too many to name here. To all of my fellow PhD students and colleagues from around the world who have provided me with support, feedback and access to their own research, thank you.

Particular thanks go to the staff of the University of Warwick for their backing, and to my supervisor, Professor Kevin Butcher, for his advice and guidance throughout the PhD process. Thanks also to my examiners, Dr Dario Calomino and Professor Fleur Kemmers, for their immensely helpful feedback and suggestions.

I would not have finished my PhD were it not for the constant encouragement of my family, so thank you to my parents Debby and Tony, my siblings Gemma, Joe and Jacob, my parents-in-law Clare and Phil and to everyone else who has put up with my moaning over the years.

As with everything I do, this thesis is dedicated to my wife Judi whose kindness, patience and care has made this work possible, and to my son Christopher who inspires me to be better every day.

Declarations

A paper entitled 'The Severan reforms of the late second century AD: a case of monetary déjà vu?,' based on research undertaken for the chapter 'The Crisis of the Third Century Part 1: the Denarius,' was published in 'Debasement: Manipulation of Coin Standards in Pre-Modern Monetary Systems' (ed. K. Butcher, Oxford 2020).

The author confirms that all work included in this thesis is the candidates own, and that this thesis has not been submitted for a degree at another university

Abstract

Gresham's Law, the oft-quoted aphorism that 'bad money drives out good', is a theoretical lens through which coinage reforms and their effects are usually interpreted. However, as the wealth of evidence available to us continues to increase, it is becoming clear that this can no longer be stated with certainty. The extent to which the public was aware of and reacted to coinage reforms is a continuing point of contention, as is the impact of these responses on monetary policy and the wider economy.

My research aims to begin to fill this deficiency in modern scholarship through a large-scale examination of silver coin hoarding patterns from across the Roman Empire, alongside select studies of hoards from beyond the frontiers. This study is being carried out in conjunction with new analyses of the composition of Roman silver coinage, currently being undertaken by Professor Kevin Butcher and Dr Matthew Ponting. By examining changes to the way people hoarded coins, we can begin to investigate the extent of public knowledge of reform and the nature of any ensuing reaction. This in turn can help to shed new light on a variety of subjects, from the nature of hoarding and Roman conceptions of value to the role of coinage reforms in precipitating the so-called 'Crisis of the Third Century.'

The reforms of Nero, Domitian and the Severan emperors are examined in detail through an analysis of coin hoards and their contents, before the similarities and differences between each series of events are discussed. A repeating pattern of debasement, popular reaction, renewal and recall is identified, suggesting commonalities between coinage reforms across a two-hundred-year timespan. This in turn demonstrates the value of carefully considered large scale coin hoard studies to students of the Roman world.

List of abbreviations

ASR = Robertson, A.S (2000) An inventory of Romano-British coin hoards (London: Royal Numismatic Society).

CH = Price, M.J (ed.) (1975-1985) Coin hoards (London: Royal Numismatic Society).

CHRB = *Coin Hoards of Roman Britain*

Depeyrot = Depeyrot, G. (2011) 'Catalogue de quelques trouvailles monétaires (et autres documents) en Algérie, Libye, Maroc, Tunisie,' working paper published at https://cnrs.academia.edu/GeorgesDepeyrot, accessed 30/12/2019

dFRMO = Digitale Fundmünzen der Römischen Zeit in Österreich, https://www.oeaw.ac.at/antike/forschung/documenta-antiqua/numismatik/dfmroe/, accessed 30,12,2019

FMRD = Gebhart, H., Kraft, K., Alföldi, M.R. (eds) (1960-2010) Die Fundmünzen der römischen Zeit in Deutschland (Berlin: Gebr. Mann).

FMRL = Weiller, R. (1972-1996) Monnaies antiques découvertes au Grand-Duché de Luxembourg/Fundmünzen der Römischen Zeit Im Großherzogtum Luxemburg (Berlin: Gebr. Mann).

FMRN = Alföldi, M.R., Vin, J. P. A. (eds) (1992-2002) Die Fundmünzen der römischen Zeit in den Niederlanden (Berlin: Gebr. Mann).

FMRS = Kos, P., Alföldi, M.R. (eds) (1988-2014) Die Fundmünzen der römischen Zeit in Slowenien (Berlin: Gebr. Mann).

FMRU = Lányi, V., Fitz, J., Bakos, M., Torbágyi, M., Redő, F., Farkas, E., Kelemen, M.H. (eds) (1990- 1999) Die Fundmünzen der römischen Zeit in Ungarn (Bonn: Rudolf Habelt).

Gazdac = Gazdac, C. (2010) *Monetary circulation in Dacia and the provinces from the Middle and Lower Danube from Trajan to Constantine I (AD 106-337)* (Cluj-Napoca: Mega Publishing House)

Mira = Martinez Mira, I. (1995-2005) 'Tesorillos del s. III d.C. en la Península Ibérica I-III,' *Lvcentvm*

TAF = *Corpus des trésors monétaires antiques de la France*.

List of Tables

List of Figures

Introduction

This thesis aims to assess the social and economic reactions to reforms of the Roman silver coinage in the period from the reign of Domitian (AD 82-96) to the reign of Gallienus (AD 260-268). Recent studies of the metrology and metallurgy of the silver coinage by Kevin Butcher and Matthew Ponting will be used to gauge the scope and scale of three major coinage reforms of the period under consideration (under Domitian, Septimius Severus and Caracalla). Changes to coin circulation patterns, as indicated by the contents of coin hoards, will then be used to evaluate the popular reaction to coinage manipulation. The entirety of the Roman empire will be examined in order to identify any regional dissimilarities and select sources for coin circulation patterns beyond the frontiers will also be assessed. The main source of evidence for the thesis will be a database of coin hoards from across the Roman empire and beyond, although relevant single find and documentary sources will be referred to when appropriate.

This chapter will provide a general introduction to the state of relevant numismatic study at the present time, followed by a detailed description of the methodological approach which will be used in this thesis. The subsequent chapters will then be devoted to a series of case studies of individual coinage reforms and their effects on the monetary economy of the Roman empire in the second and third century AD. Finally, a chapter summarising the specific findings of each case study and the general results of the overall thesis will conclude the work.

Metrological and metallurgical studies of the Roman silver coinage

An excellent overview of the history of scholarship on the standards used to produce the Roman silver coinage has recently been published in Kevin Butcher and Matthew Ponting's monograph, and it is not the intention to reproduce such a conspectus here.[1] However, given the importance of metrological and metallurgical data to this thesis, a brief overview of developments will be provided.

A detailed and systematic study of the material composition of the Roman silver coinage was neglected by numismatic scholars for centuries. Several works made piecemeal attempts to examine the metal content or approximate weight of individual coin series, extending as far back as Guillaume Budé's *De asse et partibus eius* in 1514.[2] However the first major work in the field, as in so many other areas of classical study, was produced by

[1] Butcher and Ponting (2015) chapter 3.
[2] Budé (1514)

Theodor Mommsen. His 1860 *Geschicte de römischen Munzwesen* brought together the results of the previous three centuries of metrological and metallurgical study to provide an overview of the development of the Roman coinage from the Republic to Diocletian.[3] Mommsen, following the work of his predecessors, identified the reigns of Nero, Domitian, Trajan and Septimius Severus as watersheds in the development of Roman coinage standards. Nero reduced the weight of the denarius from 84 to 96 to the pound and the fineness from 100% purity to 80-90%. Domitian then increased the fineness back to over 90%, before it was again lowered by Trajan. Severus then debased the coinage further to around 40-50% silver, leading to a rapid decline in standards during the third century.

Mommsen also provided an extensive commentary on his results, seeing the debasement of the silver coinage as a reaction to the establishment of a bimetallic currency from the time of Julius Caesar onwards. The fluctuating market values of gold and silver made the creation of two full metallic value denominations with a fixed exchange rate impossible, so from Nero onwards gold was used as the standard of value while the silver currency became increasingly fiduciary through debasement.[4] Subsequent recalls, such as that under Trajan, were motivated by profit, as evidence by the survival of more debased issues such as the 'legionary' denarii of Mark Antony.[5] Such currency manipulation led to finer silver coinage becoming overvalued against the gold, resulting in the operation of Gresham's Law (as indicated by preferential hoarding following the reforms of Nero[6] and of Septimius Severus).[7] Mommsen's view of debasement proved to be enduring and several of his ideas are echoed in scholarly works to the present day.

With the exception of the 1908 synopsis of data by Josef Hammer,[8] very few analyses of the metrology and metallurgy of the Roman coinage were produced during the following decades. Scholars instead turned to the study of coin finds; a topic discussed further below. It was only after the Second World War that new techniques and analyses began to be produced. In the 1960s, the French scholars Jeanne Condamin, Maurice Picon and Julian Guey published a series of works warning of the problems of the surface enrichment of

[3] Mommsen (1860); *Histoire de la monnaie Romaine,* the French translation with corrections and additions by the Duc de Blacas published between 1865 and 1870, is the version which is usually referred to and will be used here.
[4] Mommsen (1873) 44-48.
[5] Mommsen (1873) 31-32.
[6] Mommsen (1873) 49-51.
[7] Mommsen (1873) 56.
[8] Hammer (1908).

coins.[9] This phenomenon, where the outer layer of a coin contains a higher proportion of silver than the original alloy used, could be caused both naturally by the preferential corrosion of copper during burial and cleaning and (unknown to Condamin, Picon and Guey) artificially by enrichment processes used at the mint. Condamin, Picon and Guey were concerned that prior analyses did not take this issue into account and so produced fineness figures which were too high. They emphasised this by conducting a series of chemical analyses of late second and early third century coins, demonstrating that the non-oxidised interior of coins was considerably less fine than global analysis would suggest.[10]

Some scholars heeded the warnings of Condamin, Guey and Picon,[11] but many others were enamoured with the new analysis technique of X-ray fluorescence (XRF). This non-destructive method promised accurate results, with the only damage to the coin being a mild abrasion of part of the surface in order to remove the patina and overcome the effects of natural corrosion. The next comprehensive study of Roman silver was by one such supporter of XRF, David Walker, and was entitled *The metrology of the Roman silver coinage*. Published in three parts between 1976 and 1978, Walker's *Metrology* quickly became the standard reference work on the composition of the Roman silver coinage in the period between the beginning of the reign of Augustus (31 BC to AD 14) and the end of the reign of Uranius Antoninus (AD 253 to AD 254). The general narrative of reform followed that of previous analyses, with debasements under Nero, Trajan, Antoninus Pius, Septimius Severus, Caracalla and then almost continual decline from Gordian III onwards, with temporary restorations of silver fineness under Domitian, Marcus Aurelius and Pertinax.

Like Mommsen, Walker provided a commentary on the debasements and their effects. In this he was influenced by the 'primitivist' ideas of scholars such as Moses Finley and A.H.M Jones, which had become the prevailing viewpoint on Roman economics during the middle of the twentieth century. Walker's studies concluded that the debasement of the silver coinage coincided with periods of financial strain, largely due to increased state expenditure, and that the debasement of the coinage was preferred to increased taxation thanks to pressure from the Roman elite. The Roman imperial period saw a series of debasements which, in Walker's view, would have contributed to increasing price inflation.

---

[9] Condamin and Picon (1964); Condamin and Picon (1965); Guey (1965); Condamin *et al.* (1965); Condamin *et al.* (1967); Condamin and Picon (1972); Condamin *et al.* (1973).
[10] Condamin and Picon (1964) *passim*.
[11] Caley (1964) 66; Reece (1968) 112; Cope (1972).

However, the development of the economy in the first two centuries of the imperial period largely absorbed the effects of the expanding monetary pool, with major inflation only taking place in the third century AD. This inflation, coupled with the increasing overvaluation of the silver coinage caused by successive debasements, led to the ultimate collapse of the denarius-based monetary system in the late third century AD.

The influence of Walker's work on numismatic study in the following decades was substantial. His view of debasement as a fiscal 'sticking plaster' used to cover deficits in the Roman state's budget largely conformed to the view taken by previous studies on the topic, but his work was the first to provide significant quantitative evidence to support his hypothesis. His metrological and metallurgical figures also provided the basis for many subsequent studies in the field of Roman numismatics and economics, several of which have proven highly influential.

However, Walker's work almost immediate came in for criticism. I his review of Walker's work, Andrew Burnett noted the difference between Walker's figures and those provided by earlier destructive analyses.[12] The problem lay with the fact that, despite the surface abrasion used, Walker often did not completely penetrate the enriched surfaces of coins meaning that results obtained were too high. This became apparent with the work on Nabatean coinage carried out by Michael Cowell and Karl Schmitt-Korte. Working with a sample of coins also used by Walker, Cowell and Schmitt-Korte obtained results quite different to previous analyses. They suggested that this was due to incomplete abrasion by Walker, and to test the theory cut one of the coins in half. Examination of the interior of the coin showed that the outer third was considerably finer than the heart metal due to surface enrichment.[13] This considerable layer of surface enrichment was unlikely to be the result of natural corrosion processes during burial or of modern cleaning techniques, both of which generally left an enriched layer only a few microns deep. Despite the progress under Condamin, Picon, Guey, Cowell and Schmitt-Korte, the picture remained incomplete.

The next piece of the puzzle was found by Susan La Niece in her examination of a set of chisels found at Ur.[14] These three tools, hitherto thought to be solid gold, were found to actually be composed of a base gold-copper alloy with a thick enriched layer of gold at the surface. La Niece recognises the appearance of the chisels as characteristic of depletion

[12] Burnett (1980) 214.
[13] Schmitt-Korte and Cowell (1989) 44-52.
[14] La Niece (1995) 41-47.

gilding, a process whereby an item of base gold would be heated to cause the oxidation of copper at the surface before being treated with an acidic substance used to dissolve the resulting copper patina. This effect occurs naturally during prolonged periods of burial but results in only a relatively thin layer of enrichment a few microns deep and creates a distinctive pitted surface where copper has been leached from the alloy. La Niece argues that this is not the case with the Ur chisels, as the enrichment layer is too thick and the surface too smooth due to the apparent use of burnishing tools. Instead La Niece believes that depletion gilding was used deliberately to enhance the appearance of the item while minimising production costs, as had already been noted in ancient finds from the Americas.[15]

It was not long before La Niece's findings were applied to the Roman coinage and the deficiencies of XRF analysis. Kevin Butcher and Matthew Ponting's 1995 study of Vespasianic coinage from Caesarea in Cappadocia cites the 'likelihood of intentional enrichment of silver at the coins surface' as rationale for using a drilling technique which allowed them to dispose of metal from the surface of the coin in their analyses (discussed in more detail below.)[16] In a later work, Butcher, Ponting and Graham Chandler suggest that the technique used for depletion silvering may have developed as a method to remove the layer of black copper oxide which would coat a coin flan after casting, with the effect of making the surface more silvery being a happy side effect (albeit one which would have been exploited by the minting authorities to the fullest.)[17]

Ponting's 2003 study of the Severan coinage with Haim Gitler identified that imitation denarii of Septimius Severus had an enriched layer of silver of around 200 microns deep, while the sprues and other waste materials (which were cast from the same 57% silver alloy used for the coin flans) only had surface enrichment to a depth of tens of microns.[18] This provides strong evidence that an artificial depletion silvering process was used on the coins, as compared to the waste products which had only been subject to natural corrosion. Several additional works by Butcher, Ponting and others have continued to discuss the evidence for surface enrichment, including results of drill bit analyses and coin cross-sectioning.[19] A recent, excellent paper by Nicola George discusses silvering processes,

[15] La Niece (1995) 43.
[16] Butcher and Ponting (1995) 66.
[17] Butcher *et al.* (1997) 31-33.
[18] Gitler and Ponting (2003) 125.
[19] For example, Butcher and Ponting (2005); Ponting (2009); Ponting (2012).

the history of research in the field and modern experiments to recreate ancient techniques for the production of coin blanks in detail.[20]

The purpose of the Roman mint in silvering the surface of the coinage is considerably easier to divine than the method by which it was achieved. By artificially enriching the surface of the coin, the state could continue to present debased denarii as 'pure silver.' Trust in the quality of the precious metal coinage was key to enabling effective circulation, as evidenced by the fact that the state went to significant lengths to preserve the illusion of a pure silver currency.[21] In a world where access to information was extremely limited by modern standards the outwardly silvery appearance of the denarius would serve to convince the majority of its users (if not all, as we will discuss later) that the coin continued to be produced using pure bullion. Popular knowledge of the manipulation of the silver coinage would have to come from alternative sources, at least while surface silvering remained an effective technique.

There are hints in ancient literary sources, such as the *Historia Naturalis* of Pliny the Elder,[22] a letter from the scholar Fronto to Marcus Aurelius,[23] Arrian's *Discourses of Epictetus*[24] and the *Historiae Romanae* of Cassius Dio,[25] that some individuals were aware of manipulation of the coinage despite the efforts of the mint. The epitomist who abridged Dio's writings on Caracalla even outright states that 'while others (of his shameful deeds) he revealed unintentionally through his efforts to conceal them, as, for example, concerning money,' a possible direct reference to surface silvering.[26] However these sources are often factually incorrect in their descriptions of debasement indicating that the authors' knowledge of the subject was incomplete. Likewise we cannot extrapolate the knowledge of the privileged equestrian and senatorial authors of these works to the majority of the Roman coin-using population.

The creation of this thick enriched layer, created by a combination of natural corrosion and deliberate depletion silvering by mint workers, limits the ability of XRF and other

---

[20] George (2020) *passim*.
[21] Elliott (2020) 136.
[22] Pliny the Elder, *Historia Naturalis* 33.46.132.
[23] Fronto, *De Oratoribus* 17.10.
[24] Arrian, *Discourses of Epictetus* 4.5.
[25] Cassius Dio, *Historiae Romanae* 78.15.
[26] Cassius Dio, *Historiae Romanae* 78.15.1. It is possible that this quote instead refers to the introduction of the antoninianus, as discussed *infra* 165-166. We also must be cautious when placing weight on the works of Byzantine epitomists who may have misunderstood or garbled the original text.

techniques to identify the nature of the alloy used by the mint to strike the coin. Non-destructive techniques cannot penetrate the enriched zone consistently, and the removal of copper alloy at the surface will drive up the perceived silver content in any global analyses of the coin. As the silver content of the original alloy is the figure that numismatists require in order to create an accurate account of metrological and metallurgical changes to the coinage over time, it became evident in the mid 1990's that a new technique combining the accuracy of wet chemical analysis with the non-destructive nature of XRF needed to be found.

Beginning in 1995, Butcher and Ponting sought to provide this new technique.[27] Butcher and Ponting's method involves drilling a small hole into the side of coins to be examined, removing a sample of the heart metal of the coin which can then be examined using wet chemical analysis.[28] While technically 'destructive', the resulting hole is small and unobtrusive, and it can easily be filled in or disguised if necessary. This technique provides data on the composition of the alloy used to produce the original coin blanks, negating the effects of both artificial and natural surface enrichment. Some scholars have argued that by removing the artificially enriched layer on the surface of the coin, Butcher and Ponting are not examining the fineness of the whole coin as it was issued.[29] However they argue that it is more important to understand the alloy used to produce the coin blanks, as this is the alloy that the mint controlled and because surface enrichment was carried out for aesthetic reasons rather than to change the fineness of the coin.[30]

Butcher and Ponting's work provides an important corrective to that of Walker, and their figures will provide the basis for this thesis. Data for the period Nero-Trajan is taken from their recent monograph, *The metallurgy of the Roman silver coinage from the reforms of Nero to the reforms of Trajan*.[31] Results are now being produced by Butcher and Ponting for the next stage of their programme, examining the coinage of the Severan emperors. This has been kindly provided by the authors and will be used during the second case study.

One important point to make concerns the data used for the weight of the denarius. As Butcher and Ponting point out, it is only possible to take the weight of the coin as it exists

[27] Butcher and Ponting (1995); Butcher *et al.* (1997); Butcher and Ponting (1998); Butcher and Ponting (2005); Gitler and Ponting (2007); Butcher and Ponting (2009); Butcher and Ponting (2012); Butcher and Ponting (2015); Butcher and Ponting (2016).
[28] This technique is described thoroughly in Butcher and Ponting (2015) chapter 5.
[29] Howgego (2009) 290.
[30] Butcher and Ponting (2015) 87-88.
[31] Butcher and Ponting (2015).

now. This may not be exactly the weight at which the coin was issued, particularly for debased coins as the copper may have been preferentially leached or corroded out during centuries of burial. This makes it difficult to detect whether changes in weight, particularly small ones, are indeed reflections of deliberate changes at the Roman mint. Butcher and Ponting's figures will be used where possible as the most recent data in the field, but it is important to remember this caveat.[32]

Gresham's Law: theory and practice

The theoretical concept of Gresham's Law is often cited as the maxim 'bad money drives out good,' but this is an oversimplification. More accurately, Gresham's Law suggests that if two forms of currency circulate together at the same legal value but with different intrinsic values, the currency with the higher intrinsic value (i.e., the one which is legally undervalued) will be hoarded, melted down or otherwise leave circulation. The currency with the lower intrinsic value (which is legally overvalued) will be preferred in exchanges and continue to circulate. This is an extension of the rational choice theory of economics, whereby when faced with a decision the average person will choose the option with the least cost or the most gain for themselves. Gresham's Law, or at least its effect, was recognised by Aristophanes,[33] discussed by Copernicus and Nicolaus Oresme[34] and was named by Henry Dunning Macleod after Sir Thomas Gresham, an Elizabethan courtier and financier who had described a similar phenomenon occurring in his own day.[35] More recently the theory underpins several important monetary studies, and discussions of coinage reforms and circulation patterns are often set in a framework with Gresham's Law as a basic principle.[36] However few scholars devote their time to discussing and evaluating Gresham's Law as a theoretical concept, which given its importance as an analytical tool and model is a major deficiency in many studies of the ancient economy. It is often treated as an unavoidable consequence of debasement, and any apparent discrepancy between the expected effects and the available evidence is treated as either an indicator of the inherent unreliability of the data or the failure of Gresham's Law as a model.

This lack of analysis makes the recent work of Colin P. Elliott crucial. Following on from his PhD thesis on the subject, Elliot has produced several discussions of Gresham's Law, some

[32] Butcher and Ponting (2015) 90-96.
[33] Aristophanes, *Frogs* 718-737.
[34] Balch (1908) *passim*.
[35] Macleod (1858) 475-477.
[36] See, for example, Bolin (1958); Rathbone (1996); Duncan-Jones (1994); Katsari (2011) etc.

of which has been published.[37] Given the importance of Gresham's Law as a theoretical background and heuristic tool in this thesis, Elliot's work will be discussed here in detail.

Principally Elliott argues that, whilst Gresham's Law in itself is *a priori*, it is often used as an *a postiori* statement by scholars to be supported by empirical evidence in a positivist framework.[38] He suggests that this is unhelpful, and instead that data should be used to determine, not whether Gresham's Law is correct as a model, but whether it actually applies in any given circumstance. In order to function properly, Gresham's Law has three prerequisites which are often not accounted for in formulating the concept:

- A legal price for coinage must be in place and it must be actively *enforced*.
- Coin users must *recognise* the disparity between the legal and the bullion value of coins.
- Coin users must *value* the difference between the legal and the bullion price of coins enough to take advantage of it.[39]

If these prerequisites are fulfilled then Gresham's Law should operate as expected, with undervalued coins being driven out of circulation through hoarding or melting down. However, if one or more factor is absent then Gresham's Law may operate incompletely or not at all, potentially helping to explain irregularities in coinage circulation patterns. Examination of the evidence can then help to determine whether Gresham's Law was in operation in any given period, thereby shedding some light on the economic circumstances of the time.

Elliot claims that the only scholar so far to have come close to using Gresham's Law in this way is Dominic Rathbone in his significant article 'Monetisation, not price inflation, in third century AD Egypt?',[40] where empirical evidence is used to suggest, not that Gresham's Law is correct or otherwise, but that it did not apply in mid-third century Egypt. Elliott praises Rathbone's use of Gresham's Law as 'a slivered opening towards and entire gateway through which new methodologies can impact upon the studies of ancient history' which has unfortunately been ignored by scholars.

This position on Gresham's Law feeds into Elliott's wider point; that the external factors surrounding economic activity and history as a whole cannot be stripped away from the

[37]Elliott (2020); Elliott (2014).
[38] Elliott (2020) 146.
[39] Elliott (2020) 144.
[40] Rathbone (1996).

'internal' judgements and motivations of the actors who take part in events.[41] The author agrees with this stance. Economics is not a science, but rather an application of multiple disciplines including anthropology, sociology, psychology, archaeology and history. We must attempt to put aside decades of dimetric opposition between scholars and attempt to work in the intersections of our knowledge. It is only here that we can hope to gain a better understanding of how the ancient economy worked and impacted the lives of those who lived through it.

Elliott then applied the methodology cultivated in his PhD to the Roman monetary economy in his article 'The acceptance and value of Roman silver coinage in the second and third centuries AD.'[42] Elliot's overarching argument is that changes to the silver coinage in the second century AD did not subject the monetary economy to the effects of Gresham's Law as coin users remained unaware of their nature and extent. Conversely the actions of Septimius Severus and his successors in debasing the coinage and abandoning the denarius in favour of the antoninianus led to an increased awareness of the differences in the intrinsic values of the silver currency in circulation. This was due to the combined effects of the abandonment of the Neronian weight relationship between differing denominations[43] and a noticeable change in the appearance of the coins[44] and. This heightened public concern, augmented by the increasing availability of professional assay services to the general populace,[45] led to a breakdown in public trust in the state's valuation of coinage and led coin users to take action to conserve the bullion value of their currency. This in turn caused Gresham's Law to operate as it had not during the second century AD.

This public awareness of debasements and the attendant breakdown in trust is what differentiates third century debasements from previous reforms in Elliott's model. By the end of the third century people seem to have been fully aware of changes in the coinage and acted to protect their wealth accordingly, rather than treating debasements as moralistic issues.[46] The third century crisis, according to Elliot, was:

---

[41] Elliott (2020) 173-176.
[42] Elliott (2014).
[43] Elliott (2014) 135; Elliot's statements as to which reforms may have been accompanied by weight changes may need to be revised in light of the warning given by Butcher and Ponting on attempting to establish weight standards from surviving coin evidence. Butcher and Ponting's work seems to suggest that the majority of denarii between the Neronian reforms and the reign of Commodus were minted at 3.4-3.45g, with slight weight changes under Domitian (an increase) and Nerva (a decrease); Butcher and Ponting (2012) 66-67 and Butcher and Ponting (2015) 90-99 and 701.
[44] Elliott (2014) 138
[45] An issue discussed further below, see n.59.
[46] Elliott (2014) 149-152

> *'…one where the behaviours and customs of the second century were merely operating at a much greater pace. In this sense, there definitely was a second century currency crisis- its natural consequences were merely deferred until later.'*[47]

Elliott's work is vital in that it uses Gresham's Law as a theoretical concept which can illustrate facets of the ancient economy, rather than as a model to be proven or disproven by empirical evidence. It is this approach which will be adopted throughout this thesis.

Conditions for the operation of Gresham's Law

Elliot's first and third prerequisites for the operation of Gresham's Law, the enforcement of legal coin values by the state and the desire of coin users to realise the greatest possible value from specie, touches on one of the major debates in studies of the ancient economy. The very first coined monetary economies generally assigned value to coinage based on the inherent worth of the precious metal from which they were made, building on earlier traditions of barter exchange and commodity monies.[48] This contrasts with modern monetary systems, whereby coins derive their value from the fiat assigned to them by their issuing authority. Rather than having any intrinsic worth, modern coins are positioned in a denominational hierarchy. They circulate based largely on public trust in the authority of the issuing state and the strength of the economies which use them, and their relative values on international free markets are often a reflection of the depth of that trust. Precious metals still carry out some of the traditional functions of money, notably as a store of wealth, but fiat money and credit are the predominant mediums of exchange in modern economic systems. These two contrasting currency systems, based on intrinsic value or fiat value, are often described in modern economic studies as metallism and chartalism respectively. This dichotomy was first coined by Georg Friedrich Knapp in his 1905 work *The State Theory of Money*,[49] and it has become a common lens through which to view state and public attitudes to money and value.

---

[47] Elliott (2014) 152.

[48] Some currencies, such as the Greek obol, appear to have developed from archaic ritual practices or standard base metal utensils such as cooking spits or axes. As such they can be seen to have chartalist characteristics in some respects, as their value is at least partially derived from social convention rather than intrinsic worth; see Semenova (2011). However monetary uses of such objects were generally secondary to their main purpose as ritual items or practical tools, and most units of value were derived from weights of precious metals. It is the latter system that was used for the valuation of coined money following its development in seventh century Asia Minor; see Kroll (2012).

[49] Knapp (1924); this reference is to the English translation of the 4th edition.

Metallist and chartalist monetary systems have been in operation throughout world economic history, sometimes concurrently. For example, the precious metal currencies of the Greek city states derived their value from their value as a commodity, as described above. However, following its inception in the city-states of Sicily in the mid-fifth century BC, the bronze coinage which formed the lower value denominations of the Greek currency system operated as partial fiat money. A large proportion of the value of the base metal coins was determined by the ability to exchange a fixed number of them for silver denominations rather than from the intrinsic value of the metal which they contained.[50] Determining which system of valuation predominated at any given point in time is crucial to understanding the interactions between the state, the public and the monetary system, particularly when attempting to use Gresham's Law as a model. Gresham's Law is generally applied presuming a metallist outlook on behalf of the state and the coin-using public. However, if chartalism was predominant in the period under discussion then changes to the intrinsic value of the coinage may have had a limited impact, if any, on monetary circulation patterns if public trust in the state's fiat remained strong. A modern example of this would be the US five and ten cent coins, the former of which contains almost three times the value of precious metal as the latter. However due at least in part to the strength of state fiat, the undervalued five cent coin is not driven out of circulation by the hugely overvalued ten cent coin.[51]

The value system in use during the Roman imperial period is a topic of debate amongst scholars. Generally, the Roman currency system is held to have leant towards metallism in its precious metal coinages and chartalism in its base metal denominations (at least from the time of the Second Punic War onwards).[52] However some scholars argue that the precious metal currency, particularly the silver coinage, acquired fiduciary aspects following debasements. Reducing the silver content of the denarius while retaining the official exchange rate of 25 denarii to the aureus would lead to an overvaluation of the silver coinage in relation to gold (assuming the aureus remained pure). If a post-reform coin was intended to circulate at the same face value as its pre-reform predecessor then part of its value would be derived from state fiat (i.e., it's official value as 1/25th of an aureus) rather than intrinsic worth. Opinions on the reasons behind this overvaluation vary, with some suggesting that it was intended to cover the costs of minting and others proposing that it

[50] Fischer-Bossert (2012) 147-148.
[51] Bransbourg (2011) 89.
[52] Discussed at length in Bransbourg (2011), especially 87-91.

was an attempt at profiteering by the state. Regardless, the overvaluation of the silver currency in relation to gold would imbue the silver coinage with at least partial fiat value, and as such influence the operation of Gresham's Law.[53]

However, detecting the valuation preferences of economic actors during the Roman imperial period is a difficult task, if not an impossible one. In his article arguing for a predominantly metallist perspective on both Roman and early Chinese coinage systems, Walter Scheidel lists several of the deficiencies in modern knowledge which limit our ability to approach the topic of coin valuation in ancient world. Chief amongst these is a lack of detailed information about the relative prices of gold and silver bullion over time. Further problems include a lack of evidence for the scale of monetisation and the credit economy, and of prices for goods and services.[54]

Added to Scheidel's objections can be the issue of the relative face values of coins in the ancient world. We are reasonably confident about the hierarchy of centrally issued Roman denominations under Augustus, with one aureus being valued at 25 denarii, itself worth 4 sestertii or 16 asses. However, there is little reliable information for the relative values of denominations beyond this point. Additional problems are caused by the introduction of a new silver denomination under Caracalla in AD 215, conventionally known as the antoninianus or radiate, which became the predominant silver coin within the empire from the AD 230's onwards. This coin weighed around one and a half times as much as a contemporary denarius, but the prevailing scholarly opinion is that it was worth twice as much in terms of face value. This would greatly overvalue it against the denarius, the aureus and potentially the market value of its own silver bullion content, making the silver coinage even more fiduciary. However, a face value of the two denarii to the antoninianus is open to debate, and this topic will be discussed further in the chapter on the Severan reforms.

Despite the apparent overvaluation of silver coinage during the Roman imperial period, wider evidence strongly suggests that metallist preferences still played a large role in determining the value of individual coins. The Roman mint maintained tight control over the weight and fineness standards used for both denarii and aurei and preserving the

[53] As with so many theories in this field, the notion of debasements leading to a wholly or partly token silver coinage stems from Mommsen (1873) 44-47. More modern adherents to this theory include West (1941) 57; Bolin (1958) chapter IV *et passim*; Lo Cascio (1981) 79; Lo Cascio (1996) 275-276; Katsari (2011) chapter 7 and Butcher and Ponting (2015) 235.
[54] Scheidel (2010) 102-103.

appearance of a 1:12 ratio between the two denominations appear to have been key in the reforms of the first and second century AD. Surface enrichment techniques, designed to increase the silver content of the outermost layers of a denarius in order to improve its appearance, were widely used. Attempts were made to improve the quality of the denarius under Nero and Domitian, despite the expense that this would incur. All of these measures would be unnecessary if the quality of the coinage, or the public's perception of it, was of no importance.

Scheidel argues that the public had generally metallist preferences, while the state appears to have favoured nominalism as far as was practical.[55] Bransbourg,[56] Elliot[57] and Butcher and Ponting[58] agree with Scheidel's assessment. All of these works appreciate the important role of public trust in the coinage, and Elliot attributes the monetary changes of the third century at least in part to a breakdown of the confidence of the public in the currency.[59] As long as this trust was maintained, the state could manipulate the precious metal content of the coins for its own ends. However, if this manipulation became obvious, as Elliot argues for the third century, public trust would be damaged and the fiduciary elements of the coinage would inhibit their ability to circulate effectively.

Measuring the state's ability to impose its chartalist preferences is the key in determining how the value of coinage was measured by the public and how they reacted to coin reforms. If the state did not attempt to impose face values, then coin issues of higher intrinsic values would simply circulate at a premium rather than be removed from circulation. There are several surviving imperial edicts attempting to compel legal exchange rates for imperial coinage. An inscription from Pergamum records a ruling of Hadrian requiring money-changers in that city to sell denarii for 18 local bronze *assaria* and to buy them for 17 *assaria*, following accusations that they had been charging illegal exchange rates.[60] Septimius Severus issued a similar decree to the money changers of the city of Mylasa in around AD 210, prescribing harsh penalties for those who exchange money on the black market.[61] The so called 'Currency Edict' or 'Aphrodisias Currency Inscription' of Diocletian mandates tax payments and the settlement of private debts at the rate at which

[55] Scheidel (2008) *passim* and Scheidel (2010) *passim*.
[56] Bransbourg (2011) *passim*.
[57] Elliott (2014) 140-148.
[58] Butcher and Ponting (2015) 235.
[59] Elliott (2014) 148-152.
[60] *OGIS* 484, translated and discussed in Macro (1976) *passim*.
[61] *OGIS* 515.

the coins used were issued.[62] An edict of Constantine in the Codex Theodosianus states that all *solidi* of the proper weight should be exchanged at the official value, in response to the apparent practice of discounting certain coins with a smaller imperial portrait.[63] The fact that these edicts were issued repeatedly reinforces the notion that the state was invested in supporting the denominational hierarchy and the fiat value of its currency. It also suggests that a market for currency exchange existed outside of official channels despite repeated 'legislative' attempts to supress it, and that individuals were willing to risk considerable punishment to profit from the discrepancies between official and market rates for coins. However, with the possible exception of the last example, none of the above edicts explicitly indicates that that the precious metal content of coins was the reason for variable market prices for coins. Other considerations, such as the ability of imperial currency to circulate more widely than local coinages, may have led certain issues to become more attractive to coin users allowing them to circulate at a premium.

If the state could not successfully compel the public to circulate coinage at face value through words, then perhaps it could through action. By decreeing certain coins as acceptable for tax payment, and the rates at which taxes need to be paid, the Roman state could imbue its coinage with fiat value which may have outweighed the metallist concerns of coin users. The Roman state and its bureaucracy was, in general, very small in relation to the size of the empire and the populace it governed.[64] In addition, the problems of slow communications, corruption, the collection of some taxes in kind and external factors such as warfare and plagues would have further limited the state's ability to compel legal exchange rates through taxation. However, there is abundant evidence for the widespread collection of monetary taxes, especially in the form of tax records from Egypt.[65] It is likely that most, if not all, of the Empire's populace would have been eligible to pay some of the myriad taxes in cash. This is particularly pertinent following Caracalla's extension of citizenship, and therefore the tax liabilities of citizens, to all free-born males in the empire in AD 212.

---

[62] Erim *et al.* (1971), fragment b.
[63] *CTh* 9.22.1.
[64] Bagnall (1996) 66; he estimates 1 state official for every 5,000-10,000 inhabitants of Roman Egypt in the fourth century AD. He compares this to the one city employee for every thirty residents of New York City in 1996. It is also probable the fourth century bureaucracy was considerably larger than that of the second and third centuries; see Lo Cascio (2005), especially 132-136.
[65] Lewis (1983) 165-172.

The third of Elliot's preconditions, the significance placed on the differential between the face value and the intrinsic value of coinage issues, is even harder to quantify as it requires us to make assumptions about the circumstances and mentality of ancient coin users. The internal logical consistency of Gresham's Law and the overarching principle of rationality in economics suggests that coin users will conserve value for themselves where possible, but the bounds of what was considered valuable is almost impossible to know. A related issue is determining the scale of the associated outlays involved in conserving bullion value, including the expenditures involved in melting down coins, the ability of private actors to sell bullion on the open market or to mint coins (the issue of so-called 'free minting,' discussed further below) or the inherent costs in removing coinage from use through hoarding. The costs mentioned above may have severely diminished or even completely negated any gain obtained through the reminting or hoarding of coin, but without a method of assessing their extent it is impossible to say. Documentary sources from the later third and fourth centuries suggest that, by this point, concern over fluctuations in the intrinsic worth of coinage issues led coin users to take steps to preserve their wealth as best they could,[66] but there is no such documentation for the first, second and early third centuries AD.

This having been said, the author believes that it is reasonable to assume that the majority of coinage users in the Roman period would have valued changes in the precious metal coinage enough to attempt to conserve value where possible. Silver was a valuable commodity and the two reforms to be considered in this thesis had significant effects on the bullion content of the coinage.[67] Wealthy coin users may have found it more practical to melt down or remint their coins, but it is not unreasonable to suggest that people of more limited means may have been both willing and able to exchange their finer denarii for a premium to moneylenders, jewellers or merchants.

If it is granted that official values for coins were stipulated and enforced by the state where possible, and that coin users would value the difference between the official and bullion exchange rates of various coin issues where possible, it is therefore the second of Elliot's propositions, the knowledge of the coin user, which determines when and how coin users react to reforms.

---

[66] See for example P.Ryl.607 and P.Oxy.48.3401, discussed in Elliott (2014) 149-150.

[67] See table 1 above; there is a difference of 0.83g of silver per denarius between Domitian's finest and least fine issues, while the difference between the pre- and post-reform denarii of Septimius Severus is 0.75g per coin.

Elliott discusses this in detail. He proposes that initially the weight of coins would have been the most evident indicator of their value and suggests that the apparent care taken in the minting process to preserve target weights points towards the importance of this metric to coin users. Weight decreases under several emperors, such as Nero and Commodus, would advertise coinage reforms whereas simple fineness changes likely would not.[68] Evidence indicates that coins were counted out in exchange rather than weighed from at least the second century onwards.[69] However this does not preclude the use of weight in transactions, particularly large ones where weighing coins would be much quicker than counting them individually.[70]

Elliot proposes that the reforms of Septimius Severus acted as a watershed in public perceptions of coinage value. Silver/copper alloys naturally take on a brown or pink hue as the copper content exceeds 50%, as occurred under Severus, and this may have made the lower quality of the coins known to many users for the first time. This in turn reduced public trust in the coinage.[71] However this glosses over the impact of the surface silvering techniques in use at the Roman mint, which would have concealed the appearance of the copper. Heavy wear may have exposed the more copper rich heart metal of the coin, but this was unlikely to be the case after normal use.[72] These methods would have been effective until the base metal content of the coinage passed c.90% (around the time of Trebonianus Gallus), at which point the silver content of the coins was too low to produce a silver-rich layer on the surface and the appearance of the coins deteriorated noticeably.[73]

Elliot also proposes that the third century saw an increase in the availability of 'black market' coin assay services, with formerly state-sponsored currency specialists moving away from official activities in response to market demand.[74] As evidence, Elliot cites

---

[68] Elliott (2014) 135; see also Butcher and Ponting (2012) 66-67 and Butcher and Ponting (2015) 90-99 and 701.
[69] See Gaius, *Institutes* I.123, discussing payment by weight in former times 'eorumque nummorum vis et potestas non in numero erat, sed in pondere.'
[70] A practice which continues in modern banks, where bags of coins of the same denominations are weighed when deposited.
[71] Elliott (2014) 138.
[72] Butcher and Ponting (2015) 107-110.
[73] Butcher and Ponting (2015)
[74] The existence of *nummulari* and *argentari*, the two money-specialists to whom Elliot ascribes the provision of assay services, is well attested. The testing of coinage for plating or forgery is also evident, both in the archaeological record and literary sources (see Crawford (1985) 241.) However whether *nummulari*, *argentari* or others would provide accessible and practical assay services, particularly given that ancient assay methods were wholly destructive, is currently a matter of speculation. Arrian's *Discourses on Epictetus* describe the testing of money, but this appears to be done using physical examination rather than scientific testing; Arrian, *Discourses of Epictetus* 1.20.7-

documentary sources from the third and fourth centuries describing official condemnation of extra-legal exchange services.[75] The introduction of the notational *denarius communis* in the late third century would have aided these black market exchanges by allowing various issues to be given different comparable values.[76] Money changers and assayers seem to have become more and more vital as people's metallist preferences meant that they desired to use coinage at as close to bullion value as possible, and larger numbers of black market financial services became available as time went on. Elliott proposes that this shift may have led to reliable coin valuation services becoming more readily available to a large proportion of the public, in turn increasing the economy's sensitivity to coinage debasements.

The process of coin withdrawal

If we accept that Gresham's Law is logically cogent and consistent with the actions of rational economic actors, and it can be proven that all of the factors required for the operation of the Law are in place following a coinage reform, then we would expect 'bad' coin to drive 'good' coin from circulation. The next step is to consider exactly how this process would work. There are four potential methods for the realisation of the bullion value of coins; have the coins melted down and reminted into new issues, have the coins melted down and converted into other precious metal items (such as jewellery or plate) or sell the coins directly as bullion on the market.

In the modern world, it is relatively easy to conserve the bullion value of coins using the latter method. For example, prior to 1947 British pre-decimal silver coins were minted containing silver bullion, whereas their modern decimal 'silver' equivalents use cupronickel alloys or copper plating. Although pre-decimal coins are no longer legal tender, several banks (including the Bank of England) will exchange them for their face-value equivalent in decimal coins. However, due to increases in the price of precious metal over the past 60 years the intrinsic value of pre-decimal coins is much higher than their notional face value. For example, 40 silver sixpence coins minted before 1947 have a face value of around £1, but the silver they contain is worth around £20 at current market prices. For this reason, it is easy to find coin dealers, bullion dealers or jewellers who will buy pre-1947 coins in order

9. The author's personal belief is that assay services would likely have been available in a system that seems to have placed value on the precious metal content of the coinage, but that they may not have been particularly accurate and that they may only have been useful to individuals or organisations making use of large quantities of coin.

[75] Elliott (2014) 140-148.

[76] Elliott (2014) 140-141.

to melt them down or sell them on. However, it is not possible to have pre-decimal coins reminted into decimal issues, and it would be very difficult to have the coins melted down and remade into other precious metal items. Modern coins can be sold as bullion, but generally not used as bullion.

Which options were open in the ancient world is a major source of debate. Moneychangers were ubiquitous in cities and towns throughout the Roman period, changing imperial coins for local issues and exchanging denominations for one another. Whether they were able to differentiate between coins of the same denomination issued on different standards is uncertain. Moneychangers operated in under contract with the local authorities, who would likely attempt to enforce legal exchange rates between denominations. Allowing the discounting of certain issues by weight or fineness would undermine these exchange rates, so it seems unlikely that officially sanctioned moneychangers would offer such a service. However, it is entirely plausible that 'black market' coin changers, as well as other parties interested in acquiring precious-metal bullion such as jewellers or metalworkers, would offer premiums for high quality coin issues. The legality of such transactions is unknown.

Another option for the sale of high-quality precious metal coins as bullion was to export them beyond the frontiers of the Roman empire, where legal exchange rates did not apply. There is extensive hoard evidence for the export of fine Julio-Claudian silver coin, particularly C L CAESARES issues of Augustus and seated Jupiter types of Tiberius, to India during the first and second centuries AD.[77] Hoards of Roman silver in the European *barbaricum* regions tend to begin with coin issued towards the end of Nero and end with those issued around the beginning of the reign of Septimius Severus, a fact that was once taken to indicate preferential export of fine silver second century denarii following the debasement of AD 194. However, scholarly opinion has now shifted towards the view that the second century denarii in northern Europe represent the cessation of monetary subsidies to Germanic tribes under Septimius Severus.[78] Such large scale export would have been expensive and difficult for the average Roman citizen to undertake, but it may have been possible for merchants and other large scale coin users as demonstrated by the Indian hoard evidence.

[77] de Romanis (2012) *passim*.
[78] For the former viewpoint, see for example Crawford (1978) 152-153; for the latter, see Kolendo (1978) 169-171; Berger (1996) 55-61; Bursche (2008) 55-56.

The melting down of coinage for reminting by private individuals (so-called 'free minting' or 'free coinage') or the production of precious metal item would provide another option for ancient actors wishing to conserve the bullion value of their coins, but the availability of such services in the Roman era is uncertain. In the medieval period it was common to take coins to a local mint for exchange into different issues or denominations, and mints even competed for business against one another by offering lower commissions than their rivals.[79] There is no explicit evidence for such activity during the Roman period, so most scholars reject it as a possibility.[80] However as has been stated before, an absence of evidence is not evidence of absence and some academics remain open to the possibility that free minting may have occurred in some form during the Roman period.[81] The existence of free minting would make state-mandated coinage reforms considerably easier to enact, and provide an explanation as to how the mint managed to recover coin during periods of recycling. At the present time free minting in the Roman period cannot be conclusively proven or disproven, but it is worth bearing in mind as a possible mechanism leading to changes in the composition of the coinage circulation pool.

Reminting by the state, on the other hand, was carried out reasonably frequently. Phases of coinage recycling appear to have followed both the Neronian and Severan reform series, with older coin being taken in and reminted into new issues. The coinage recall of the late first and early second century is even mentioned by Cassius Dio, who claims that Trajan 'caused all of the money that was badly worn to be melted down.'[82] The main issue with this mechanism is exactly how the state recovered coin to recycle. Free minting provides an attractive solution with medieval corollaries, as discussed above. Another potential solution is the recycling of finer coin submitted as tax payments, although such a process would take a long time and is based on the assumption that monetary taxes were returned to Rome rather than spent in the province in which they were collected. Finally, the state could simply issue a decree ordering old coins to be returned for recycling, although this would likely alert the populace to the higher intrinsic values of these issues and lead to preferential hoarding. Most episodes of coinage recycling take place over several decades, so the taxation hypothesis seems the most plausible based on current evidence.

[79] Sargent and Velde (2001) 128-129.
[80] See for example Buttrey (1961b) 86; Crawford (1970) 47 n.67; de Callataÿ (2005) *passim*.
[81] Howgego (1990) 19-20; Butcher and Ponting (2015) 29-30.
[82] Cassius Dio, *Historiae Romanae* 68.15.

The final method of realising the bullion value of undervalued issues is simply to hoard them, retaining them as a store of wealth while using overvalued coins as the medium of exchange. This method would be open to all but the poorest in Roman society (who likely would not have had enough coin both to cover their financial liabilities and to set some aside) and would be most evident immediately around the time of coinage reforms when the number of pre-reform coins in circulation was at its highest. By definition, hoarded coins are not in circulation (although they may return to circulation at some point in the future), and the relationship between the composition of hoards and that of the coinage in general circulation is difficult to determine. Assessing the impact of hoarding on the composition of the circulation pool is problematic, not least because of the lack of comparative documentary and material evidence, but due to the relative ubiquity of coin hoards detecting episodes of preferential hoarding (or the lack thereof) has become one of the major metrics for assessing public reactions to coinage reforms.

To summarise, the process by which undervalued coin would leave circulation if Gresham's Law were in full effect is still in doubt. Export beyond the frontiers may have occurred, but the evidence suggests that this was not as widespread as once thought. Public melting down of old coin would have been difficult without free minting. The recycling of old coin by the state and the preferential hoarding of coin by the public are likely to have been the most significant effects of Gresham's Law in the Roman period, and as such detecting these processes is key to determining when, where and how the public reacted to coinage reforms.

The evidence: formation, deposition and recovery

Finds of ancient coins are generally grouped into one of two categories: 'site' or 'stray' finds and hoards. Site finds are individual coins which appear to have been accidentally lost by individuals and never recovered, while hoards are groups of coins which appear to have been deliberately deposited together. Documentary evidence, such as the legal commentaries of ancient jurists or the corpus of ancient papyri discovered in Egypt, can provide an important corollary to coin finds but is too limited to stand on its own. Both categories of coin finds have their own advantages and pitfalls as sources of evidence on the ancient economy, and these will be discussed here briefly

Site finds, when properly recorded during controlled archaeological investigations, provide a generally accurate picture of the coinage which was in use in day to day life during the period in which a site was occupied. As such they can provide an insight into the scale and

nature of economic activity on a site and have been used successfully in such a manner by scholars on several occasions.[83] However the use of site finds has several issues. One problem is denominational bias. As a rule, precious metal coins are uncommon as site finds while base metal issues are plentiful. This is likely due to the fact that more valuable coins would occasion a much more detailed search if dropped than low value ones, and as such are more likely to be found and not left to posterity as a site find. Another issue is dating. Outside of certain contexts with known closing dates, such as buildings or settlements like Pompeii with limited occupation periods, dating exactly when a coin was lost is impossible. The date at which a coin was struck provides a *terminus post quem*, but beyond that a coin could have been lost at any point. This limits the usefulness of site finds to narrative studies on the history of the ancient coinage, such as the present work. [84]

As a result, this thesis will focus on the analysis of coin hoards, here defined as groups of coins which appear to have been deliberately deposited together as opposed to those accidentally lost. Coin hoards form a valuable corpus of evidence and are often used as one of the main primary sources in studies of economic history, but the processes through which they were created, lost and then recovered remain largely obscured to scholars. Some preliminary discussion of these topics will help to illustrate the potential pitfalls of coin hoards as evidence.

The relationship between coin hoards and the wider circulating pool of coinage in the Roman empire is a topic of much debate. Traditionally, scholars have divided coin hoards into categories based on a subjective assessment of the intentions of the hoarder in creating them, such as 'savings hoards', 'emergency hoards,' 'votive hoards,' 'purse hoards' *et cetera*.[85] Each hoard would have a different profile reflecting their purpose, with 'purse hoards' containing smaller denominations for everyday use, 'savings hoards' comprising high-value coins put together over the course of many years, 'emergency hoards' including whatever was at hand and so reflecting the money in general use at the time of deposition and so on. As such, the contents and context of finds are often used to support their categorisation. For example, a small hoard of mixed denominations may be seen as the remains of a purse used for daily economic activity, while a larger, high value hoard containing coin issues spanning many years may be categorised as a 'savings' deposit.

---

[83] One of the most recent and notable of such works is Kemmers (2006), discussing the coin finds from the legionary fortress of Nijmegan in the Netherlands.
[84] An excellent discussion of the interpretation of site finds can be found in Reece (1996) *passim*.
[85] See for example Christiansen (2004) 15-17; Lockyear (1996) 72; Grierson (1975) 134-159.

These categorisations are then invoked when discussing the historical significance of hoards and their contents, such as linking a high number of 'emergency' hoards in a specific region to military activity or some other disaster.

However, it is almost impossible to make such categorisation with certainty.[86] Does the find of an aureus represent the stray loss of a coin from a man's purse or the deliberate deposition of the monthly wages of a legionary? Was a hoard of 100 denarii a workman's life savings or the hurried collection of coins deposited by a trader afraid of a Germanic invasion? Archaeological context can sometimes provide details as to the reasons behind hoard formation and deposition, particularly in the cases of grave goods and some votive deposits.[87] However generally speaking the categorisation of hoards in the manner described above is so problematic that it will be avoided in this thesis.

Another trend in hoard studies is to attempt to analyse, not why hoards were created, but why they were not recovered in the first place. With the exception of most votive and funerary deposits, it is likely that all precious metal deposits were intended to be recovered by their owners. The most common explanation for the non-recovery of coin hoards is military activity, particularly barbarian incursions or raids. This theory was first expounded by Adrien Blanchet in 1900[88] and has remained influential in many studies throughout the twentieth and twenty-first centuries.[89] However others doubt this interpretation, particularly British scholars who note the lack of evidence for widespread military activity in Britain despite the large number of hoards found in the province.[90] As mentioned above, a popular alternative theory for the non-recovery of coin hoards is votive practise, as these hoards would generally be deposited without the intention to retrieve them. This is already a common model for hoarding practises in the prehistoric and pre-Roman Iron Age eras,[91] and several scholars now emphasise the importance of continuity of ritual activity

[86] Bland (2013a) 214-215; Butcher (2013) 3-4 and 10-14; Reece (1987) 61-62; Katsari (2011) 15.
[87] As well as temple sites, water-related contexts such as wells, riverbeds or bogs are thought to be indicative of ritual deposition. For example, the coinage from the Sacred Spring at Bath covers the whole period of Roman occupation and likely represents an assemblage of coins thrown into the well as offerings rather than a hoard, Walker (1988). Similar finds include those from Coventina's Well (Allason-Jones and McKay (1985)) and the River Tees at Piercebridge (Walton (2008)).
[88] Blanchet (1900)
[89] See for example Crawford (1969) *passim*; Gerov (1977) *passim*; Mirnik (1981) 50, 52-53, 59 and 75; Robertson (2000); Abdy (2002) 64; Gazdac (2012) *passim*.
[90] For example Mattingly (1951) 282; Reece (2003a) 338-340 (a reprint of Reece (1981a)); Guest (2015) *passim*.
[91] Bradley (1998).

throughout the Roman period.[92] However the use of coinage as votive objects is largely divorced from their use in economic activity, and votive hoards such as well deposits were likely built up over a long period of time rather than deposited together in one event as a discrete mass. As a result, votive deposits are generally unhelpful as tools for analysing the circulation patterns of coins at any one point in time, and thus will be avoided in this work where identifiable.[93]

Understanding processes of hoard formation, deposition and loss is crucial in determining how representative hoard evidence is of the circulating pool of coinage at any particular point in history, and therefore how far hoard studies can be relied upon when analysing the ancient economy more generally. While some scholars doubt that coin hoards accurately reflect the pool of coinage in circulation,[94] many numismatists have argued convincingly that if an analysis of a large number of coin hoards suggests a generally homogenous pattern then it is likely that their contents are a faithful representation of the available coinage at any one time.[95] As such, coin hoards (if they conform with the pattern suggested by other contemporary deposits) will be taken as a largely representative sample of the silver coinage in circulation at the time of their deposition. However, the uncertainty surrounding the topic serves to illustrate the importance of archaeological context in studies of coin hoards, as greater contextualisation is one of the few approaches which may provide some answers to the riddle of non-recovery. Such work is beyond the scope of this thesis, but it is hoped that ongoing collaborative ventures such as the 'Hoarding in Iron Age and Roman Britain' project at the British Museum and the University of Leicester will continue the progress made in this area in recent years.

The next major problem with the use of coin hoard evidence is dating. Historically, the date of deposition for a coin hoard has been tied to the issue date of the last coin which it contains, on the basis that a coin hoard cannot have been buried before its most recent coin was produced. However, strictly speaking such a dating method only provides a

---

[92] Aitchison (1988) *passim*; Aarts (2005) 17-27 *et passim*; Haselgrove and Wigg-Wolf (2005) *passim*; Hobbs (2006) 120-134; Guest (2015) 104-105 and 111-112

[93] Bland (2013a) 214-215.

[94] Bruun (1978) *passim*; Aitchison (1988) 271-274.

[95] Grierson (1966) viii; Reece (2003c) 269-272 (a reprint of Reece (1974)); Reece (2003d) (a reprint of Reece (1981b)) Crawford (1983) 201; Reece (1987) 46-70; Duncan-Jones (1994) 115 (but earlier he argues that most coin hoards are the result of donatives and congiaria, and thus are artificially created and not representative of the circulation pool; 67 and chapter 5 *passim*); Guest (1994) 16-24 (Guest accepts that hoards probably reflect the local circulation pool, but is more wary of using them for global analysis); Lockyear (1996) 260-261; Walton (2011) 134-141 (comparing coin hoards from Britain with the site finds recorded by the Portable Antiquities Scheme); Creighton (2014) 123.

terminus post quem for the hoard. *Terminus post quem* dates can provide an indication of the *relative* dating of coin hoards, in that a hoard ending with issues of AD 160 is likely to have been deposited before one ending with coin of AD 170. However, these are not *absolute* closing dates, as it is entirely feasible for hoards to have been completed and deposited years, even decades, after their final coin was struck. Kris Lockyear has also discussed the possibility that hoards, especially small ones, may not contain the most recent coin issues if they were deposited at a time of minimal coinage supply, further distorting the date given by the latest coin.[96] This creates major problems in attempting to correlate hoard dating patterns with specific historical events, a common practice in hoard studies.[97]

Sometimes it is possible to detect discrepancies in hoard dating through archaeological context. For example, a hoard of silver *victoriati* found at Numantia in Spain[98] ends with an issue of 180BC, but it was found in a camp not built until 153 BC suggesting that it was not deposited until that time.[99] However, generally speaking this is not possible to do with most hoard finds due to incomplete contextual reporting. Alternate methods of dating hoard deposition are constantly being sought. It has been suggested that if hoards contain a continuous sequence of issues and end with relatively unworn coin then they are likely to have been deposited shortly after those coins were issued.[100] The use of seriation to date coin hoards relative to one another has also been proposed.[101] Developing a new hoard dating method is beyond the scope of this thesis, so the *terminus post quem* will be identified with the closing date of coin hoards here. However, it must be borne in mind that these dates are not absolute, nor are they necessarily identical to the date at which the hoard was deposited.

Further problems with the use of hoard evidence come with the later discovery and recording of hoard evidence. Hoard finds from the 19th century or earlier are generally poorly recorded, often only as an estimate of the number of coins found and a list of the emperors represented. This reflects the antiquarian approach to classical scholarship

[96] Lockyear (2012) 203-207, building on Lockyear (1999) *passim*.
[97] For example, by Blanchet (1900) and successors in linking hoarding to barbarian invasions, or by Duncan-Jones (1994) in identifying hoards with donatives and *congiaria*.
[98] RRCH 118.
[99] Crawford (1969) 77.
[100] Katsari (2011) 12.
[101] Guest (1994) 21-22.

prevalent throughout the period, but unfortunately renders large groups of hoards unusable to modern scholars.

More modern hoard excavation and recording techniques are much more thorough, and coin finds are often the subject of detailed catalogues and contextual reporting. However, the approach to cataloguing coin finds varies from country to country. Summaries of coin finds are usually published in journals, and many countries produce regional corpora of coin finds. Several areas of continental Europe follow the example of the German *Fundmünzen der Römischen Zeit in Deutschland* (FMRD) series,[102] French coin finds are listed in the *Trésors monétaires* (TM) and *Corpus des trésors monétaires antiques de la France* (TAF) registers and Britain has the Treasure Annual Reports, *Coin Hoards from Roman Britain* (CHRB) catalogues and the corpus of known hoard finds compiled by Anne Robertson,[103] amongst other publications. However, there are very few publications discussing coin finds from regions such as the Near East, North Africa and Spain, amongst others. This leads to patchy reporting of coin finds and affects how far coin hoard databases such as the one to be used in the present work represent the hoarding patterns of antiquity. Large scale projects, such as the Coin Hoards of the Roman Empire database currently under construction at the University of Oxford and the Ashmolean Museum, will help to remedy the situation somewhat. However, it must always be borne in mind that any database of coin hoard finds will be limited by modern recovery and recording techniques and may not tell the complete story of ancient hoarding practises.[104]

Despite these issues, coin hoards remain one of the best sources of evidence for studies of ancient coinage and economics. They are abundant, widespread, relatively datable and finds are constantly increasing in number. As long as the problems of context, absolute dating and bias introduced by modern recovery are recognised and accounted for (as far as possible) in analysis, then coin hoards provide the one of the most practical and informative methods of assessing the monetary economy of the Roman period.

---

[102] Works following the FMRD template include Die Fundmünzen der Römischen Zeit in Österreich (FMRO, Austria), Die Fundmünzen der Römischen Zeit in Slowenien (FMRSl, Slovenia), Die Fundmünzen der Römischen Zeit in Kroatien (FMRK, Croatia), Die Fundmünzen der Römischen Zeit in Ungarn (FMRU, Hungary), Die Fundmünzen der römischen Zeit im Grossherzogtum Luxemburg/ Monnaies antiques découvertes au Grand-Duché de Luxembourg (FMRL, Luxembourg), Die Fundmünzen der Römischen Zeit in Polen (FMRP, Poland), Die Fundmünzen der römischen Zeit in den Niederlanden (FMRN, The Netherlands), Ritrovamenti monetali di età romana nel Veneto (RMRVe, Veneto, Northern Italy).

[103] Robertson (2000).

[104] Carradice (1983) 60; Katsari (2011) 17.

Metallurgy and hoard studies

Several scholars have attempted to integrate metrological and metallurgical data into large scale studies of coin hoarding patterns. Mommsen's *Geschichte des römischen Münzwesens*, also discussed above, was the first such major work. Mommsen viewed debasements as tacit recognition that the bimetallic monetary system established towards the end of the Republican period was unsustainable due to the fluctuating market price of silver and gold bullion. In lieu of a truly bimetallic coinage, the state based the value of the currency on gold and debased the silver. This was followed by attempts at profiteering by the state, through the reminting of finer silver coinage on debased standards. Mommsen argued that the reforms of Nero and Septimius Severus were watersheds in coin circulation patterns in the Roman empire, with pre-reform coin being preferentially hoarded before rapidly disappearing from circulation through the actions of Gresham's Law and price inflation escalating along with the increased money supply. Mommsen's work proved highly influential, and it was long taken as read that Gresham's Law was the natural consequence of the coinage reforms of the Roman period.

However, as the quantity of available data grew during the first half of the twentieth century, cracks began to appear in Mommsen's narrative. Particularly problematic was the fact that pre- and post-reform coins could often be found hoarded together, suggesting that the preferential removal of finer coin was not the immediate response to coinage reforms. Gunnar Mickwitz noted this and suggested that Mommsen was incorrect in describing the post-Neronian silver coinage as fiduciary. The overvaluation of the silver coinage was instead a result of the imposition of a fee on the conversion of bullion into coinage rather than the effect of debasement, and it was this overvaluation that allowed pre- and post-reform coinage to circulate together.[105]

Many small-scale studies of coin hoards and metallurgical data were produced in subsequent decades, but the next major effort to produce a large scale analysis of the impact of reform on hoards and the economy was Sture Bolin's 1958 work *State and currency in the Roman empire to 300 AD*.[106] In this influential text, Bolin follows on from Mickwitz in attempting to determine what enabled fine, heavy pre-reform coin and more debased, lighter post-reform coin to circulate together following the Neronian reforms of AD 64-68. Taken *a priori*, Gresham's Law suggests that the older coin should have been

[105] Mickwitz (1932)
[106] Bolin (1958).

preferentially removed from circulation. However hoard evidence and a thorough examination of Pompeiian hoards and site finds indicates that older issues were circulating well into the Flavian period.[107] Bolin arrives at the conclusion that the state overvalued silver coinage in relation to silver bullion by approximately 25%, achieved by adding a fee or tax when the state purchased silver for the mint.[108] Such a fee probably as a kind of seigniorage or minting charge, and here Bolin follows the ideas of Mickwitz. However, he does propose that the state could also have used its monopoly on the minting of coin to generate profit through such a fee. If the value of the silver coinage were based only partially on its intrinsic metal content, heavier and lighter coins could circulate effectively together as long as debasement did not exceed certain bounds which Bolin calculates using various formulae.[109]

Bolin argues that these limits were exceeded during the reign of Trajan, leading to the recall of Republican and pre-reform Julio-Claudian issues (with the exception of the debased 'legionary denarii' of Mark Antony)[110] which is mentioned in the history of Cassius Dio.[111] Subsequent debasements then led to further removal of older issues, a process which continued until the continuous inflation and debasements of the third century led to bullion becoming as highly valued as coinage by the time of Diocletian. This in turn finally led to the collapse of the denarius system and the overvaluation of precious metal currency.[112]

Since its publication, Bolin's thesis has been subject to many criticisms. Substantivists, such as A.H.M Jones, argue that Bolin ascribes complex formal economic thought and policy to the Roman state in overvaluing the coinage which Jones believes that 'there is every reason to believe was far beyond it.'[113] Lack of consideration for other factors, such as the state's role in the mining of precious metal[114] and the wear on coinage in circulation,[115] also

---

[107] Bolin (1958) 80-86.
[108] Bolin (1958) 87-103.
[109] Bolin (1958) 104-130 *et passim*.
[110] Bolin (1958) 56.
[111] Bolin (1958) 55-58.
[112] Bolin (1958) 333 and chapter XII *passim*.
[113] Jones (1959) 161
[114] It is still relatively unknown how far the state monopolised the mining of precious metal and the supply of bullion to the mints. Historically mining and minting have been seen as solely the state's prerogative, in line with the theory that coin production was chiefly carried out in order to make state payments; see for example Crawford (1970) *passim*. However several scholars have challenged this position, potentially increasing the role of subcontractors and private individuals in the mining and minting process; see Hirt (2010) *passim* and Butcher and Ponting (2015) 113-118.
[115] Buttrey (1961b) 84-87.

impact on the validity of some of Bolin's conclusions. However, his underlying hypothesis of the overvaluation of precious metal coinage in relation to bullion, and it impact on circulation patterns, has proved enduring and is still influential in hoard studies to this day.

A more recent empire-wide hoard study, entitled *Money and Government in the Roman Empire*, was undertaken by Richard Duncan-Jones and published in 1994.[116] Duncan-Jones' work deals with a wide range of subjects, from state revenue and expenditure to inflation and coin production. Of particular relevance to the current thesis are the second and third sections of the book, entitled 'The Coin Evidence' and 'Money and Money Supply' respectively. The second section consists of an analysis of a coin hoard dataset, which includes 61 mainly gold hoards and 169 mainly silver hoards containing coins to the value of 400 sesterces or more. Duncan-Jones draws several conclusions from his analysis, the most significant of which are summarised towards the end of the section. Duncan-Jones suggests that the majority of extant hoard finds correlate with the monetary handouts known as *congiaria* (in the case of the urban plebs) or military donatives (for hoards found in the rest of the empire). Duncan-Jones advances this theory as a method to replace the so-called 'barometer of insecurity,' where periods of military or social upheaval are used to explain patterns of coin finds. However, as William Metcalf explains in his review of *Money and Government*, Duncan-Jones' evidence for the correlation between *congiaria*, donatives and hoarding is nebulous.[117] The exclusion of aes hoards and precious metal hoards worth less than 400 sesterces introduces bias into the data, the relationship between *congiaria* and donatives is insufficiently established by Duncan-Jones' evidence and linking hoards to specific historical events is difficult at best.

The following section, 'Money and Money Supply,' provides a narrative of coin output, circulation and wastage from the reign of Vespasian to that of Septimius Severus. Duncan-Jones uses various methods to calculate fluctuations in the annual output of coinage, the details of which will not be discussed here. He also attempts to determine the relationship between coin circulation speed and the rates of wear on coins, as well as annual wastage rates of coins in circulation. Of course, all of the figures provided by Duncan-Jones' are open to criticism based on deficiencies in both evidence and method. Despite the importance of such data to studies of the ancient monetary economy, calculating the size of various coin groups in circulation at any one time is notoriously difficult and some

[116] Duncan-Jones (1994) *passim*.
[117] Metcalf (1995) *passim*.

scholars despair of ever approaching a solution. However, others, the author amongst them, are more cautiously optimistic. Given the inevitable problems with the available evidence such figures will never be perfect, but they can provide an invaluable indication of fluctuations in *relative* coin production and wastage patterns when used with the appropriate caution. As such Duncan-Jones' figures can be used with the appropriate caution.

Of even more immediate relevance to the current thesis is Duncan-Jones' analysis of the apparent removal of certain coin groups from circulation at various points throughout the imperial period, as suggested by the hoard evidence. Duncan-Jones notes that early Julio-Claudian coins begin to disappear from hoards from the reign of Nero onwards, while Republican coins and the finer issues of Domitian vanish from the reign of Trajan. The reigns of Marcus Aurelius and Septimius Severus are also mentioned as periods when the coins of previous emperors are removed from hoards.[118] Duncan-Jones sees this as evidence of coinage recalls spurred by the desire to generate profit from reminting, echoing the views of Mommsen and his successors. He does note that some alleged coinage recalls, such as those under Marcus Aurelius, would have produced very little profit as they seem to have taken in coins with similar precious metal contents as contemporary issues. Duncan-Jones suggests that this may indicate an ideological dimension to some coinage recalls, citing the supposed socio-political value of displaying the reigning emperor on coins as well as the words of Cassius Dio on the recall under Trajan as evidence. These recalls do not appear to have occurred simultaneously across the entire empire, with Republican coins lasting longer in hoards from Britain and along the Danube than in other areas. Duncan-Jones claims that this is evidence of the difficulty of enacting coinage recalls in more distant provinces of the empire when compared with the central regions. A re-emergence of Republican coins in hoards from both Britain and the Danubian provinces during the later second century AD is also noted, but Duncan-Jones provides little further comment.[119]

The aims of the thesis and general methodology

As illustrated by the discussion above, the relationships between coinage reforms, coin hoards, the coinage circulation pool and the economy are complex and poorly understood. However, understanding these links is key to determining the role and impact of coinage

[118] Duncan-Jones (1994) 104-106.
[119] Duncan-Jones (1994) 196.

manipulation in the Roman period. The works of scholars such as Bolin and Duncan-Jones have gone some way to creating a unified theory on the impact of reforms on hoards, but several questions still remain. Chief amongst these are:

- Was the general Roman populace aware of coinage reforms? How did they become aware?
- If so, how did they react? Was the public response to coinage reform always the same? If not, why?
- Were reactions to coinage reforms uniform across the Roman empire? If not, why?
- Were there different responses to coinage debasements and coinage improvements?
- Is Gresham's Law a suitable model for public reactions to coinage reforms?
- Can hoard studies illustrate the rationale behind and effects of coinage reforms? Are there any commonalities between coinage reforms during the Roman imperial period?
- What was the effect of public reactions on the monetary economy and wider Roman society?

This thesis aims to answer these questions through case studies of hoarding patterns following major reforms of the silver coinage in the first-third AD: those of Domitian in AD 82-85, Septimius Severus in AD 194 and Caracalla in AD 215. The first large-scale reform of the silver coinage, that of Nero in AD 64-68, will not be the subject of a case study. This is to avoid retreading ground covered by previous works, most notably the monograph by Butcher and Ponting on the subject published in 2015. However, given the significance of the Neronian reforms to the later history of the coinage, a brief description of the events and their effects will be provided prior to the first case study chapter.

Each case study will comprise a large-scale study of hoard contents from across the Roman empire (as far as is practical), as well as select hoards from beyond the frontiers. Site find and documentary evidence will be used as corollaries to the hoard data where practical and helpful. The reasons for the choice of coin hoards as the main source of evidence have been discussed in detail above.

Hoard catalogues have been gathered from a variety of sources, listed in the Hoard Bibliography below. Hoards of silver coins only and mixed denominations are both included, but only silver coins found are listed as it is beyond the scope of this thesis to study the hoarding patterns of gold and base metal issues. For obvious reasons, hoard

catalogues which did not contain descriptions of the individual coins were excluded from the database. Where it is possible to identify any reasonable doubt that an assemblage was in fact a hoard (for example, poorly documented groups of coins in museum collections,) such finds have also been omitted. It is common for hoard studies to only include finds above a certain size or which contain a certain coinage value. The logic behind this is to avoid the inclusion of incomplete hoards, which may have altered compositions or inaccurate end dates, or to prevent statistical issues.[120] No such discrimination is used in the present thesis. Where coins have been lost in modern hoard finds, it is likely that this was a random selection from the whole hoard and thus will not significantly affect its profile.[121] Including small hoards in the database gives a larger sample size, desirable in itself, and is more likely to provide a closer reflection of the coin in circulation in antiquity. Kris Lockyear has also argued, at least in the case of Republican coin hoards, that larger finds are not necessarily more representative of the circulation pool.[122] These criteria are to some extent arbitrary and open to criticism. It is likely that through the authors error or ignorance some hoards have been included that should not, and that some have been omitted which would have been beneficial. However, it is hoped that the hoard sample size will go some way to mitigating any issues, and that future studies will be able to expand and improve on the sample used.

For each case study, hoards have been divided according to geographic region in order to highlight any regional differences in circulation patterns. Given the scarcity of finds from some areas, hoards from outside Britain have been grouped together to provide reasonably large sample sizes. The groups used are:

- Western Europe, comprising Roman provinces in modern day Spain, Portugal, France, Belgium, the Netherlands, Luxembourg, Switzerland, parts of Germany, Liechtenstein and Italy.
- Eastern Europe, including the region of the Roman Empire west of the Rhine and south of the Danube (parts of modern-day Hungary, Romania, Serbia, Slovenia and Bulgaria)
- The East and North Africa, encompassing the Roman provinces in Asia Minor, the Near East and the Mediterranean coast of Africa.

[120] Duncan-Jones (1994) 256; Guest (1994) 50.
[121] Crawford (1969) 77-78.
[122] Lockyear (1996) 260-261.

These categories are not ideal, as they do not reflect any geographic, political or economic divisions present in the Roman period. As hoard recover and recording techniques improve it is envisioned that it will be possible to subdivide these regions into smaller units more reflective of the realities of the Roman period, however they should allow analysis detailed enough to indicate broad geographic trends and highlight any regional variation in coin circulation patterns. Several hoards from beyond the frontiers of the Roman empire, from modern day Scotland, Poland, Sweden and non-Romanised regions of Germany and Romania, have also been included for comparison and to determine if coins were exported beyond the frontiers.

Hoards are dated by the *terminus post quem* (TPQ) provided by the most recent coin issue which they contain, and it is assumed that this date is the same or almost the same as the date of deposition. Having been divided by geographical region, hoards will be chronologically grouped by the decade in which their TPQ falls. If the TPQ straddles two decade groups, the earliest possible grouping will be used. These groups will run from the January of the first year of the case study to the December of the final year.

Other hoard studies commonly group finds by the reigning emperor at the time of their closure,[123] or using the 21 chronological periods devised by Richard Reece.[124] Decade groups have been preferred here for two reasons. One, both methods invite some degree of interpretation by their very nature. Reece periods are based on 'phases in which coins were minted,'[125] despite the fact that they often do not take into account major changes in the composition of the coinage (for example, the coinage of Domitian is included with that of Vespasian and Titus even though the majority of Domitian's denarii were issued on a considerably finer standard.) It is then attractive to attribute any changes in hoard composition between two periods to that change in coin production. Likewise listing hoards by emperor makes it natural to assume that any changes in hoard profiles were down to the actions of one particular ruler. For example, the disappearance of Republican denarii from hoards in Britain occurs in those deposits ending under Hadrian. However broader analysis would suggest that this was the result of activities under Domitian and Trajan, not Hadrian himself as the hoards may suggest. The second reason for preferring decade groups is for the clear presentation of data. It is difficult to represent the varying

[123] For example Bolin (1958) or Duncan-Jones (1994).
[124] First set out in Reece (1972) 271 and explained in more detail in Reece (1987) 73-76; commonly used in hoard and site-find studies, particularly by British scholars; see for example Guest (1994);Hobbs (1997); Walton (2011) etc.
[125] Reece (1972) 271.

length of imperial reigns or Reece periods in graphs but using equally sized groups removes this problem. Reece periods have been avoided altogether, but listings by reigning emperor will be included for chronological narrative purposes.

The relative percentage proportions of various coin issues within hoards will be used to compare geographical and chronological find groups in order to identify points of change in hoarding patterns. Potential causes and effects of these changes will then be explored, with the aim of answering the research questions identified above. Any case study specific issues or methodology will be discussed at the beginning of each chapter.

The reforms of Nero: a summary

The reign of Nero saw the first substantial material change to the Roman currency system since the end of the first century BC. The changes implemented under Nero, the reasons behind them and their effect on the contemporary economy have been debated by scholars for almost two centuries, and the discussion generated has informed academic views on later reform series and on the Roman monetary economy in general. It is beyond the scope of this thesis to carry out a completely new assessment of the Neronian reforms, both due to the time constraints of a PhD programme and because several recent studies have covered this period in detail.[126] However given the major impact of the debasement and in order to allow comparison between the Neronian and later reforms, a detailed summary will be provided here.

Metrology and metallurgy

As alluded to in the previous chapter, Nero's debasement of the denarius and the aureus has been evident to scholars for centuries. It is likely the decrease in the weight of the aureus in AD 64 which Pliny the Elder describes in his *Natural History* is that of Nero, although interestingly he demonstrates no awareness of the corresponding changes to the denarius.[127] Budé used this passage to suggest that changes to the weights of coins had occurred under Nero,[128] but the exact details remained very unclear and scholars continued to debate the significance of Pliny's statement. It was the work of the nineteenth century scholars Akerman,[129] Mommsen[130] and Hultsch[131] that cemented the latter part of the reign of Nero as a point of change in the Roman coinage. These early metrologists considered Nero to have reduced the weight of the denarius from 84 to the Roman pound of silver to 96 to the pound and the weight of the aureus from 40 to the pound of gold to 45 to the pound. In modern units this corresponds to an approximate change in the denarius from almost 3.7g to around 3.4g, while the aureus declined from roughly 7.8g to 7.3g.

---

[126] The most important works on the Neronian reforms and their effects are Lo Cascio (1980) *passim*; Duncan-Jones (1994) 194-200; Butcher and Ponting (2015) 201-238 and chapter 15; Butcher and Ponting (2016) *passim*. For the effects of the Neronian reforms on the Eastern currencies, see Christiansen (2004) and Butcher and Ponting (2015); for the link between the Neronian reforms and hoards of denarii in India see Turner (1989); Mac Dowall (1991) (for an alternative view see de Romanis (2012) 167-175).
[127] Pliny the Elder, *Historia Naturalis* 33.47.
[128] Budé (1514) 261-262.
[129] Akerman (1834) xv.
[130] Mommsen (1873) 23-24,30.
[131] Hultsch (1862) 235 n.17 and n.18.

Changes to the metallurgical composition of the silver coinage of Nero were more difficult to detect. Again, Akerman was one of the first to suggest that Nero debased the alloy used in denarius production, suggesting a shift from near purity to a silver content of around 90% by the end of his reign.[132] Akerman's work was followed by later historians, most notably Mommsen, and it soon became the common view that Nero had alloyed the silver with around 10% base metal.

Walker's *Metrology* generally follows the consensus on the Neronian reforms reached by the beginning of the twentieth century. His XRF analyses suggests a decrease in the silver content of the denarius from near purity to around 93.5%, while he provides an average weight of 3.19g for the twenty-four post-reform denarii in his sample.[133] It was quickly recognised that Walker's average weight was compromised by the inclusion of worn coins, and a correction was provided by Richard Duncan-Jones who estimated that the target weight of a post-reform denarius was around 3.36g.[134] At around the same time David Mac Dowall provided a weight of 7.3g for the post reform aureus, a figure confirmed by Duncan-Jones.[135]

The most recent survey of the Neronian reforms, that of Butcher and Ponting, suggests several changes to the data and chronology provided by Walker. Butcher and Ponting's results indicate that in AD 64, following a possible 'transitional' issue produced at around 90% fineness, Nero reduced the silver content of the denarius to c.80% and its target weight to c.3.45g. Concurrently, the target weight of the aureus was reduced from c.7.66g to c.7.35g. Importantly, Butcher and Ponting have identified that in AD 68 there was then an improvement in the purity of the denarius back to c.90% silver, with no corresponding increase in the weight of the aureus.[136] As the most up-to-date and methodologically sound study of the metrology and metallurgy of the Neronian coinage, Butcher and Ponting's figures will be used throughout this thesis.

The causes

Theories on the rationale for the Neronian debasements have varied widely. The most common viewpoint is profoundly negative, seeing the reforms of AD 64-68 as a response to

[132] Akerman (1834) xiv
[133] Walker (1976) 17-25.
[134] Duncan-Jones (1994) 225.
[135] Mac Dowall (1979) 138; Duncan-Jones (1994) 216.
[136] First identified in Butcher and Ponting (2005) 178-180 *et passim*; expanded upon in Butcher and Ponting (2015) chapter 9 *passim* and appendices 1 and 2.

a financial crisis caused by fiscal mismanagement. Nero's personal extravagance is described in detail by ancient authors such as Tacitus,[137] Suetonius[138] and Cassius Dio,[139] and these authors also describe how such prodigal spending led to the exhaustion of Rome's monetary reserves and Nero's attempts to replenish them.[140] Some scholars also see the cost of rebuilding Rome after the Great Fire of AD 64 as a major drain on public finances which contributed to the difficulties of Nero's later reign.[141] As a last resort, Nero debased the precious metal coinage in order to produce more specie and to profit from the recycling of older, finer issues. This ties in with the only extant ancient explanation for currency debasement, that of Pliny the Elder who describes the reform of the Roman pound during the First Punic War as a response to financial pressure and rising public debt.[142] This hypothesis stretches back to the works of Mommsen, and still finds many adherents in more modern scholarly works.

However, several points cast doubt on this theory. The *Annals* of Tacitus seems to provide evidence that Nero was in fact very concerned with preserving state revenues, transferring control of the treasury from quaestors to former praetors in AD 56 and appointing a panel of three ex-consuls to oversee state income in AD 62. Tacitus also claims Nero donated substantial amounts to the treasury from his personal funds annually, indicating that the emperor himself was solvent even if the state was not. It must also be recognised that the above narrative relies heavily on documentary sources whose authors were keen to denounce Nero as immoral and corrupt, and also that the link between the Great Fire and the reforms rests on the dating of both to AD 64, which is by no means certain.[143] A further objection is practical. Why would Nero make his reforms obvious to the coin-using public by substantially lowering the weight of the aureus and the denarius, rather than simply adding more copper to the alloy and disguising the change with surface enrichment techniques? Most crucially, this narrative generally assumes that the Neronian reforms comprised a single debasement of the coinage in AD 64. However, as will be discussed below, the recent work of Butcher and Ponting has shown that Nero in fact improved the quality of the denarius in AD 68, albeit stopping short of restoring it to purity. If Nero's

[137] Tacitus, *Annals* 15.37 and *Histories* 1.20.
[138] Suetonius, *Nero* 30-31.
[139] Cassius Dio, *Historiae Romanae* 62.17-18.
[140] Tacitus, *Annals* 15.45; Suetonius, *Nero* 32; Cassius Dio, *Historiae Romanae* 62.18.
[141] Harl (1996) 90; Howgego (1995) 118; Griffin (1984) 198.
[142] Pliny the Elder, *Historia Naturalis* 33.13.
[143] Butcher and Ponting (2015) 232-233.

objective were profiteering or increasing the money supply, why would he bother to improve the standard of the silver coinage?

Objections like these have led to various alternative theories throughout the years. Some scholars have proposed that Nero was attempting to stem the flow of fine silver denarii beyond the frontiers of the empire, a trade most clearly seen in the Roman coinage found in India.[144] However it is not at all certain that major outflows of coinage were taking place before the reign of Nero, and indeed there is evidence that such export carried on following his reforms.[145] Further alternative theories on the rationale for the Neronian reforms include the Keynesian view of an attempt to increase the money supply in order to support economic growth following a depression,[146] and even a desire to make the coinage more durable through alloying (in a similar fashion to modern sterling silver).[147] Neither of these latter two models have gained much scholarly approval, and they will not be discussed further here.

One more viable monetary explanation for the reforms of Nero is as a response to the changing market value of gold and silver bullion. The aureus and the denarius had a fixed weight ratio of 1:12 from the time of the aureus reintroduction as a regular denomination under Julius Caesar. However, limited denarius production under Caligula, Claudius and initially Nero suggest that the silver denomination may have become impractical to produce at this time. This may be explained if the market value of silver bullion had increased, as maintaining the 1:12 ratio between the denarius and the aureus would lead to the undervaluation of silver coinage and make it unprofitable to mint. Nero, recognising this issue, debased the denarius in order to overvalue it against the pure gold aureus. This overvaluation would make the denarius profitable to mint again, and also shield the currency against further changes in the relative values of silver and gold. The subsequent partial restoration of the denarius in AD 68 is then seen as a way to mitigate public dissatisfaction with the new standards. Changes to the weight of the denarius, although it would provide an improvement which would be much easier to detect, were difficult to carry out without a corresponding change in the aureus. Improving the fineness was

---

[144] Comparette (1913) 135-141.
[145] See the Vespasianic countermark on a heavily worn denarius of Augustus in the Budinatham hoard, de Romanis (2012) 170; post-AD 64 denarii found in Sri Lanka, Weerakkody (1995) 5-6 *et passim*; and the large number of hoards dating from the reign of Nero to that of Septimius Severus found beyond the Roman frontiers in Northern, Central and Eastern Europe, for example in Duncan-Jones (1994) 92-94.
[146] Thornton (1971) *passim*.
[147] West (1941) 56-57.

simpler, as the overvaluation of the denarius was merely a buffer to protect the currency from fluctuations in precious metal market values, and so the mint increased the silver content of the denarius as much as possible without undervaluation.[148]

To account for the changes in the weight of the denarius and the aureus Butcher and Ponting, building on the work of earlier scholars, have suggested that the Neronian administration was attempting to harmonise the standards used for the 'imperial' coinage in the west and the 'provincial' coinage in the east, likely for taxation purposes.[149] There is some convergence between imperial and provincial standards following Nero's reforms, with the denarius and the widely-used 'Attic' drachm both weighing around 3.45g. Several alternative drachm weights continued to be used at eastern mints during the first and second centuries AD[150] and the silver contents of coins sometimes varied from that of the denarius issued at Rome,[151] suggesting that synchronisation of the two currency systems was not total. However, regardless of its efficacy, the coordination of silver standards across the empire does provide a compelling reason for the adjustment in the weight of the denarius and the aureus under Nero.

It is almost impossible to pinpoint any one reason for the reforms of Nero. Butcher and Ponting have provided a compelling narrative which counteracts many of the inadequacies of the 'fiscal crisis' scenario which has dominated scholarly discourse on the Neronian reforms. It accounts for the apparent care taken to maintain the 1:12 weight ratio between the aureus and the denarius (a ratio which lasted in use well into the third century), as well as for the hitherto undetected improvement in the fineness of the denarius in AD 68. However, the author agrees with Butcher and Ponting in their statement that profit-making motives can never be wholly denied for ancient debasements, particularly as reforms often coincide with periods of coinage recycling. However, given the complexity of the changes to the denarius, particularly the restoration in fineness of AD 68, fiscal inadequacies are now an unsatisfactory as the sole motivation for the Neronian reform series.

---

[148] Butcher and Ponting (2015) 450-451.
[149] Butcher and Ponting (2015)444-445, building on the ideas of Soutzo (1898) *passim*.
[150] For example, the light cistophori of Asia Minor which were produced from the Flavian period; Butcher and Ponting (2015) chapter 16.
[151] A prime example are the drachms of Caesarea in Cappadocia under the Flavians, which were issued on a standard of around 50% silver bullion as opposed to the contemporary denarius standard of 80% silver; Butcher and Ponting (2015) 519-528.

The effects

Evaluating the consequences of the Neronian reforms has proved equally problematic to assessment of its causes. Gresham's Law, taken as an *a priori* statement, would suggest that the debasement of the precious metal currency should have driven the undervalued pre-reform coinage out of circulation almost immediately. However, hoards ending during the latter decades of the first century AD which contain both pre- and post-reform coin are quite common, and the find evidence from Pompeii indicates that Republican and Julio-Claudian denarii were still in use well into the Flavian period.[152] This would suggest that Gresham's Law did not operate, at least not fully, in the period following the Neronian reforms. Looking again at Elliot's three preconditions for the Law,[153] this would suggest one of three scenarios:

- The public were unaware of the reforms.
- The public were indifferent to the reforms.
- The state did not, or could not, enforce the circulation of old and new denarii at parity.

The extant evidence does suggest some public awareness of the Neronian reforms, and indeed some of the effects which would generally be associated with Gresham's Law. The majority of coin hoards ending during the reign of Nero himself close with his pre-reform issues, indicating that some hoarders in the immediate aftermath of the reform took care to exclude less intrinsically valuable issues.[154] That this preferential hoarding of fine silver denarii may have continued into the Flavian period is suggested by the evidence of hoards such as that from Este in north Italy, which contains denarii up to the reign of Tiberius but closes with an aureus of Titus issued in AD 79.[155] The previously discussed hoard evidence from India also suggests that finer silver issues may have been exported from the empire in the wake of the Neronian reforms,[156] although the lack of corresponding evidence for such a trade in the regions beyond the northern *limes*[157] and the difficulties in dating the movement of coin make this hypothesis hard to substantiate. It is also evident that, during the last decades of the first century AD and the first decades of the second, pre-reform coin was removed from circulation. This is most likely as part of a state-led initiative to remove

[152] Bolin (1958) 80-86.
[153] Discussed *supra*. 20-21.
[154] Butcher and Ponting (2015) 226-227.
[155] Prosdocimi (1891).
[156] See *supra.* 30.
[157] Bursche (2008) 53.

pre-reform issues from circulations, as will be discussed in more detail in the following chapter. However here it is important to note two points: firstly, that the act of withdrawal may have alerted the public to the desirability of certain coin issues and, secondly, that public agency in this removal of Republican and Julio-Claudian coin is entirely possible. Discrimination between issues on the First and Revised Neronian standards is hard to detect, perhaps indicating that the general populace was not aware of the fine detail of the reform series, but it does appear that on the whole the public was alert to the reform and, in many cases, was compelled to take action to preserve the bullion value of finer coins.

How popular awareness of the reforms developed is uncertain. Pre- and post-reform coins look very similar, and it is almost impossible to visually detect the difference between 80% alloy, 90% alloy and pure silver denarii (particularly when disguised using surface silvering techniques as at the Roman mint.) Assay would have made the change in denarius composition clear, but how far such services were available to the average Roman coin user is difficult to determine. The weight change of the coinage would have been more apparent, particularly in the aureus, and seems to be a more likely candidate for sparking public cognisance of the reform. However, as Butcher and Ponting point out, previous weight changes seem to have passed unnoticed and the inherent variability of coinage struck by hand may have made it hard to pick out underweight issues from the bulk of specie in circulation.

This leaves the third scenario, the lack of enforcement at par, as the remaining possibility for the limited operation of Gresham's Law following the Neronian reforms. Whether the state was unwilling or unable to compel coin users to accept new denarii at the same rate as older issues is unknown, although the limited consequences of Gresham's Law described above would seem to suggest that an unsuccessful attempt may have been made. Without parity, the heavy, fine Republican and Julio-Claudian denarii still in use following the reforms (which still made up a large proportion of circulating specie until the early second century) would likely have commanded a premium in exchange. Without extensive price data it is almost impossible to know for certain. However, a two-tier exchange system would have been a much more practical method of conserving bullion value for most coin users than hoarding, reminting or export, and it is not difficult to envisage if knowledge of the Neronian debasement was widespread. However, it may have created unforeseen issues, such as problems with taxation or difficulties in exchanging post-reform issues for pre-reform ones. Butcher and Ponting offer these complications as a rationale for the subsequent reforms of Domitian, which will be discussed in more detail below.

Summary

The reforms of Nero stand as the first major modification to the Roman currency system established at the end of the first century BC. That they had a significant impact on coin circulation patterns is clear, but what is less evident is the public response to the reform. Elements associated with Gresham's Law, such as the preferential hoarding, export and eventual disappearance of the finer, undervalued issues, can be discerned, but so can concurrent use of both pre- and post-reform issues. That there was a limited response to the reforms suggests that at least part of the populace was aware of and disquieted by the changes, but exactly how the public obtained knowledge of the reform is unknown. This concern, alongside the authorities' inability to enforce parity between new and old issues, could have created a premium market for older coins which allowed them to continue circulating alongside less fine denarii into the following decades. The subsequent fortunes of pre- and post-reform denarii will be explored further in the following chapter.

Domitian

Scholars have long recognised that the emperor Domitian carried out the first major reform to the Roman silver coinage following that under Nero in AD 64. However the character, scope and rationale for this reform have largely remained unclear. Early metrologists, such as Romé de l'Isle, noted an increase in weight of the aureus under Domitian[158] while Theodor Mommsen suggested that the fineness of the denarius increased.[159] However both passed over the event with little comment, and it was not until the beginning of the twentieth century that the Domitianic reforms began to be considered significant.

Kurt Regling's 1912 study indicated that many denarii of Domitian were absent from later hoards, and he determined that this was the result of preferential removal caused by the improved fineness noted by Mommsen.[160] Several scholars, such as Harold Mattingly[161] and Louis West,[162] attempted to dispute some of these conclusions, but the notion of the reign of Domitian as a watershed in the history of the imperial coinage slowly gained widespread acceptance.[163] The publication in 1983 of Ian Carradice's in-depth study, with its analysis of coin hoards and die studies providing convincing proof of the preferential removal of Domitianic denarii over time, cemented the place of the Domitianic reforms in the history of the imperial Roman coinage.[164]

The exact nature and scale of Domitian's reforms is much less clear. David Walker's metallurgical analyses were the first to indicate that the Domitianic reforms took place in two phases. The first, in AD 82, restored the denarius to near purity, as it had been up until the Neronian reforms of AD 64, while also increasing the weight of the aureus to early Julio-Claudian standards. The second, in AD 85, reduced the purity of the denarius significantly, albeit to a standard higher than that used by Vespasian and Titus, whilst reducing the weight of the aureus slightly to a standard used under Claudius. Walker

[158] Romé de l'Isle (1789) 124.
[159] Mommsen (1873) 29.
[160] Regling (1912), furthered in Regling (1931).
[161] Mattingly (1930) xcviii, but he does support the notion of an increase in weight under Domitian at xiii-xiv.
[162] West (1941) 71-75 supports the idea of an increase in the weight of the aureus but rejects any changes to the denarius.
[163] For example, Bolin (1958) discussed the reforms and their effects in detail.
[164] Carradice (1983) *passim*.

suggests that the weight of the denarius remained at the post-Neronian standard of 3.45g throughout both periods, while the aureus remained a pure gold coin. [165]

Butcher and Ponting have refined the figures provided by Walker's work. While not refuting the general conclusions, they have updated the fineness data for individual denarius issues using their more reliable method.[166] They also suggest that a slight increase in the weight of the denarius, from 3.4g to 3.55g, may have taken place during the period AD 82 to AD 85, although they acknowledge that this is far from conclusive.[167] In addition, Butcher and Ponting provide an extended commentary on the rationale for and the effects of the reforms of Domitian, which will be discussed further below.[168]

The Domitianic reforms are often characterised as a failure, with the debasement of AD 85 indicating the state's inability to produce a pure silver coin. This is usually attributed to fiscal mismanagement, with increases in state expenditure rapidly outstripping revenue.[169] However, it is important to recognise that the denarii issued during the majority of his reign were considerably finer that the issues which immediately preceded them. The coinage of AD 82- AD 85 would have contained around 0.83g more silver when new than issues of Titus, while those of AD 85 to AD 96 would contain approximately 0.39g more.[170]

This difference in intrinsic value would be expected to bring the economic effect known as 'Gresham's Law' into play, with the finer silver issues rapidly being hoarded, melted down or shipped beyond the frontiers. This interpretation is supported by the decline indicated by the study undertaken by Ian Carradice, with the finer coins remaining in circulation for a considerably shorter period of time than the more debased issues.[171]

However, as Colin Elliott has suggested,[172] for Gresham's Law to operate the state must institute an official value for the coinage and take steps to actively enforce it. In addition, the public must be aware of changes to the intrinsic worth of the coinage and able to distinguish between overvalued and undervalued issues. Finally, coin users must also value this difference enough to attempt to capitalise on it. Several other factors, such as the availability of specie and the size of the monetary economy, can also factor into the

---

[165] Walker (1976) 115-117.
[166] Butcher and Ponting (2015) 381-383, summarised in table 1 below.
[167] Butcher and Ponting (2015) 380-381.
[168] Butcher and Ponting (2015) chapter 13 *et passim*.
[169] See, for example, Carradice (1983) 162; Harl (1996) 92; Southern (1997) 61-62.
[170] Using the figures provided in Butcher and Ponting (2015) 701.
[171] Carradice (1983) 61-67 *et passim*.
[172] See introduction for an extended discussion of Elliott's work on Gresham's Law.

circulation life of coins independent of Gresham's Law. Comparison of the circulation of different coin standards can indicate the awareness (or otherwise) of coinage reforms amongst the general Roman populace, and in turn, can reveal the extent to which changes to the monetary economy can be attributed to changes in the coinage.

One aspect of the reign of Domitian in particular which may affect the survival (or otherwise) of his coinage is the *damnatio memoriae* proclaimed by the Senate following his assassination and the installation of Nerva as emperor. This decree would have likely led to some effort to remove the coinage of Domitian from circulation, as an obvious and widespread example of his public image. However how this would have operated, and how much of the circulating coinage the state would have been able to withdraw, is uncertain. In any case, it seems unlikely that the *damnatio memoriae* would have had a particular impact on the survival of one group of Domitianic silver over the others, so for the purposes of this case study it can be discounted.

The period under examination will extend from the reign of Domitian, beginning in AD 81, to the end of the reign of Gordian III in early AD 244, by which point the minting of the denarius had ceased and the antoninianus or radiate had taken over as the predominant silver denomination in the Roman monetary system. Beyond this point, any Domitianic denarii found in hoards are likely either extraneous or chance inclusions by hoarders who happened upon a fine silver coin and wished to retain it. In any case, a quick look through hoard catalogues shows that for all intents and purposes the denarii of Domitian had ceased to circulate by this time.

Therefore, this case study will examine the circulation patterns of Domitianic denarii of all three issue periods, comparing and contrasting them to demonstrate how differing coinage standards were perceived and used by the general public. The study will be divided according to geographic region, in order to allow comparison and to highlight any regional differences in circulation patterns, and analysis will be conducted in chronological order divided by the reigning emperor. Domitianic denarii will be divided into three groups determined by their fineness and weight; 'period 1' denarii, issued on the 80% standard from Domitian's accession in late October AD 81 to AD 82, 'period 2' denarii issued at c.100% purity between the years AD 82-85 and 'period 3' denarii produced at c.90% purity between AD 85 and the end of Domitian's reign in AD 96.

Several figures will be compared to examine changes in circulation patterns, but the two principal indicators used will be the absolute numbers of coins in hoards and what will be

referred to as the 'adjusted proportional totals'. Scholars often use the changing proportions of various coin groups in hoards to determine how usage patterns change over time. Carradice's work uses a 'monthly' proportion or 'survival rate', to take into account the fact that the first and last years of Domitian's reign were incomplete.[173] This has the additional advantage of negating the effect of the differing time scales for which each denarius issue was produced.

This study will attempt to take this notion one step further. Carradice and other scholars have observed that the rate of coin issue was very different in each of the three Domitianic periods. In general, the rate of minting in period 2 was very low and that in period 3 was very high, with period 1 in between. Carradice estimated the average total outputs of each of the three periods in his study of Domitianic denarii, using a combination of hoard analysis and die studies.[174] Whilst the problems of estimating issue sizes are well known,[175] it seems probable that Carradice's work can at least indicate the relative sizes of each issue with a reasonable degree of accuracy.

Carradice sets out three potential estimates for the issue sizes of Domitianic denarii, which differ in the set of hoards used for the calculation. The calculations here will use the figures obtained from examination of Carradice's hoards 1-43 as set out in tables F, G and L (per Carradice.) These hoards end with coin of Domitian's successors up to the reign of Septimius Severus, providing a substantial dataset of over 1,550 coins to maximise the reliability of any subsequent conclusions.[176]

Carradice provides annual and monthly totals for the number of denarii issued during Domitian's reign. By adding together the annual totals for each issue period, and apportioning the transitional years of AD 82 and AD 85 based on the approximate month in which the change to the new standard took place, the total number of denarii issued on each standard can be estimated as follows:

---

[173] Carradice and Buttrey (2007) 258-259.
[174] Carradice (1983) 74-92.
[175] Much has been said and written on this subject, for example Esty (1984); Esty (1986); Buttrey (1993); Buttrey (1994); de Callataÿ (1995); Buttrey and Buttrey (1997); Lockyear (1999).
[176] Carradice also provides estimates based on hoards deposited in the reigns of Nerva, Trajan and Hadrian only. It would be possible to undertake a similar analysis using this more restricted dataset, which could potentially benefit from minimising the impact of any preferential survival of Domitianic denarii. However the author felt that the benefit of working with the largest possible dataset outweighed this consideration.

Year	Number of months	Number of denarii issued
AD 81	3 ½ months	7,512,000
AD 82	5 months	2,108,125
Period 1 total		**9,620,125**
AD 82	7 months	2,951,375
AD 83	12 months	3,472,500
AD 84	12 months	1,354,500
AD 85	7 months	2,539,250
Period 2 total		**10,024,125**
AD 85	5 months	1,813,750
AD 86	12 months	5,400,000
AD 87	12 months	6,600,000
AD 88	12 months	20,400,000
AD 89	12 months	26,550,000
AD 90	12 months	21,818,750
AD 91	12 months	21,081,250
AD 92	12 months	32,395,000
AD 93	12 months	25,456,250
AD 94	12 months	17,193,750
AD 95	12 months	17,650,000
AD 96	8 ½ months	15,650,000
Period 3 total		**212,008,750**
GRAND TOTAL		**231,946,500**

Table 1: approximate size of Domitianic denarius issues, based on data from Carradice (1983) *74-92.*

The approximate size of each issue is therefore 9,620,125: 10,024,125: 212,008,750, which can be simplified to 1: 1.08: 22.05 (rounded up to the nearest thousandth). This ratio allows coin totals for Domitianic denarii in hoards to be adjusted to compensate for the relative size of their issue. This figure can then be rendered as an 'adjusted proportion' of coins of each reign, allowing comparison with data for other emperors and other issues. This

system allows a much closer examination of the intentions of hoarders with regards to the denarii of Domitian, as it removes the effect of different issue periods and production rates on the proportion of denarii in hoards. However it must be stressed that this is not a fool proof method, reliant as it is on a multitude of competing variables, extrapolations and decisions taken by both Carradice and the present author. As such any results or conclusions drawn from it should not be treated as absolutely correct, and the simple proportion of all Domitianic denarii in hoards under each ruler as well as the discrete numerical total of coins in each hoard and period will also be provided for comparison.[177]

Data for all Domitianic denarii in each region is summarised in Figure 1 below, to allow comparison. More detailed regional data tables and graphs are also provided at the start of each section.

Ruler	Average silver content	Average weight of denarius (g)	Average weight of silver per denarius (g)	Average weight of aureus (g)
Vespasian	80%	3.4	2.72	7.34
Titus	80%	3.45	2.76	7.34
Domitian period 1 (AD 81-82)	80%	3.4	2.72	7.34
Domitian period 2 (AD 82-85)	100%	3.55	3.55	7.75
Domitian period 3 (AD 85-96)	90%	3.45	3.11	7.63

Table 2: summary of Flavian precious metal coinage standards, AD 69 - 96. Only centrally produced 'imperial' silver and gold are considered.[178] It is assumed that the fineness of the aureus remained at or close to 100% throughout the period under examination.[179] Data taken from Butcher and Ponting (2015) 381-383.

[177] 'Proportion,' without qualification, or 'adjusted proportion' will refer to the adjusted proportional total, while 'simple proportion' will be used to refer to the proportion without adjustment.
[178] Provincial issues are excluded, as are some non-centrally produced denarii and aurei which were issued on alternative standards e.g. Clodius Albinus' Lugdunum denarii, which were produced at 80% purity.
[179] This orthodox position has rarely been subject to scrutiny, but a new examination of gold coinage standards, currently under way at the University of Warwick and the University of Oxford, should hopefully help to confirm or deny this commonly-held belief.

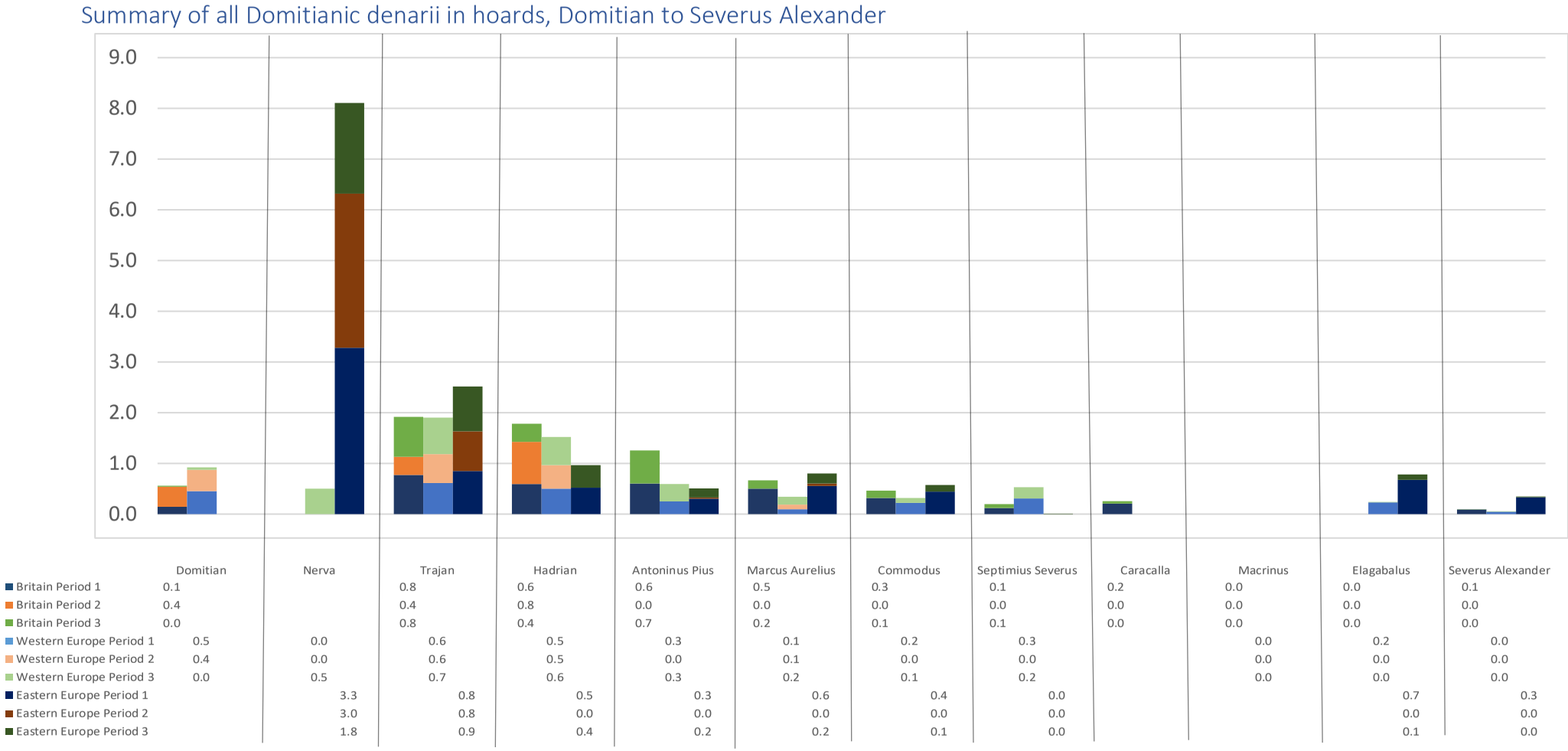
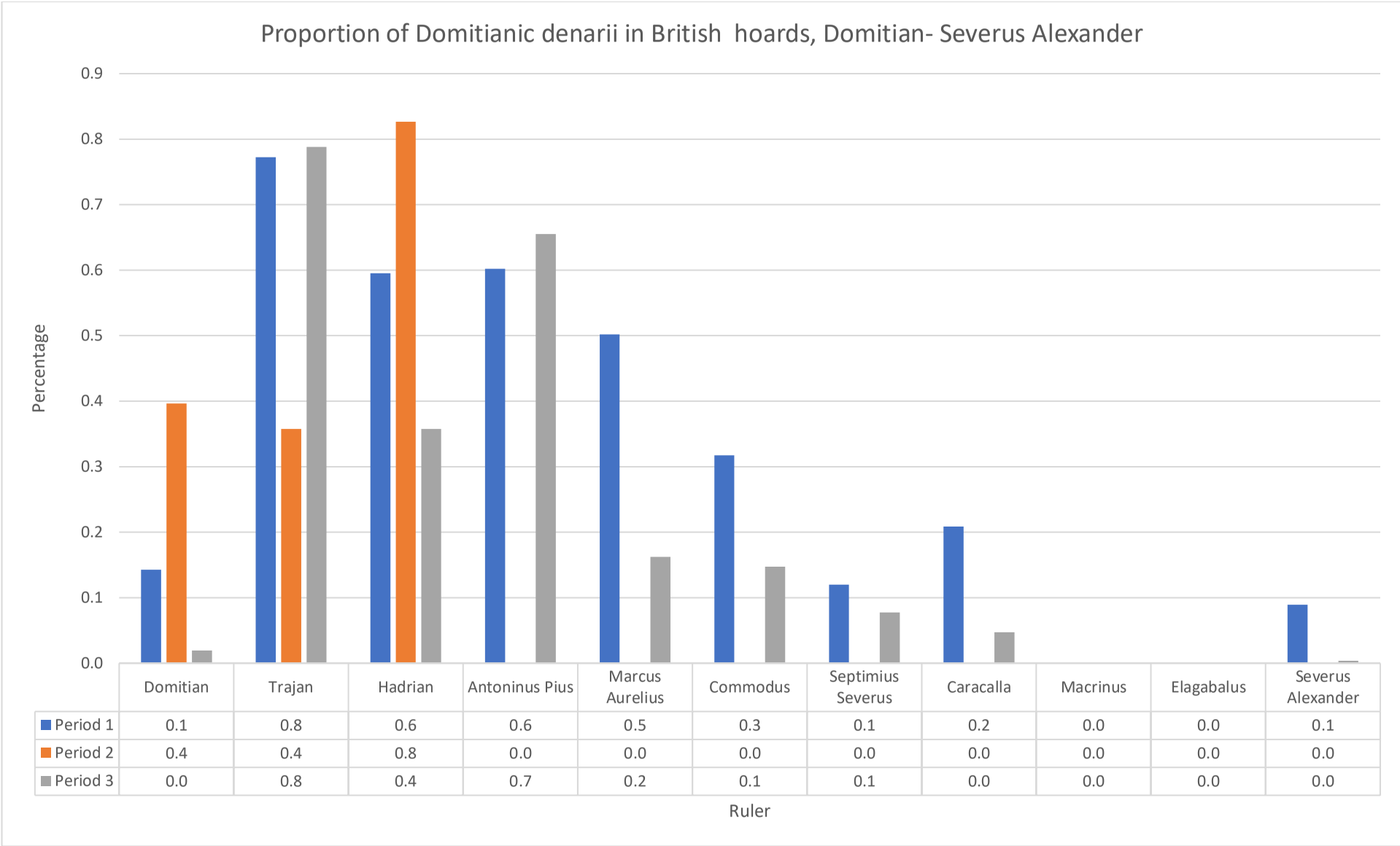


Figure 1: summary of all Domitianic denarii in hoards, Domitian to Severus Alexander. The total height of the bar represents the adjusted proportion of all coins of each period which are Domitianic, while the size of each section within the bar indicates the relative proportion of each issue period as a total of all Domitianic denarii in hoards. The first bar in each group represents Britain, the second Western Europe and the third Eastern Europe. Spaces in the data table indicate a lack of data, while 0 indicates no denarii. Detailed figures for each region, including total number of coins, is available at the start of each section. All figures are adjusted percentage proportions.

Britain

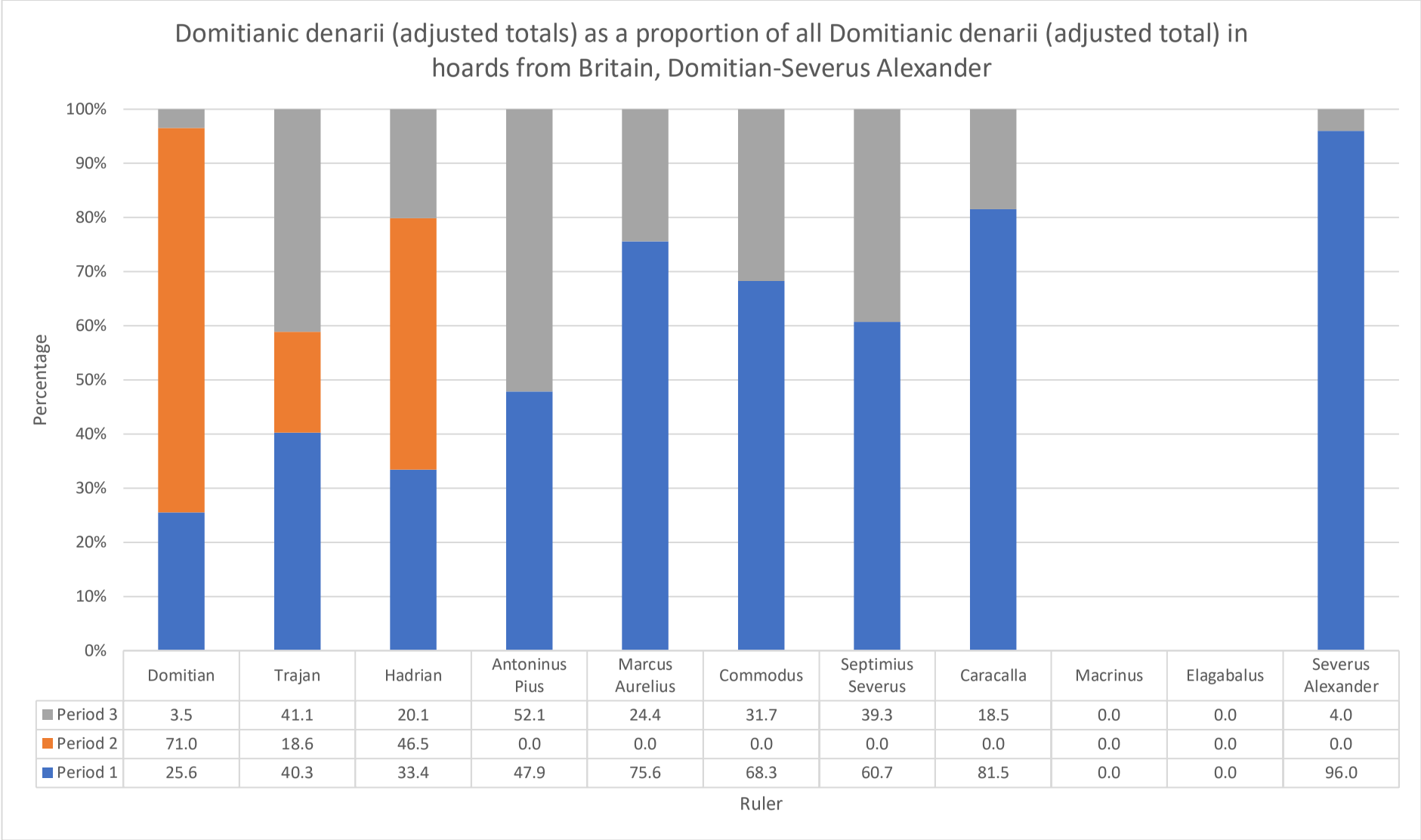
Ruler	Number of hoards	Number of coins	Period 1				Period 2				Period 3			
			Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)
Domitian	6	704	1	0.1	1	0.1	3	0.4	2.8	0.4	3	0.4	0.1	0.0
Trajan	5	302	2	0.7	2	0.8	1	0.3	0.9	0.4	45	14.9	2	0.8
Hadrian	10	727	4	0.6	4	0.6	6	0.8	5.6	0.8	57	7.8	2.6	0.4
Antoninus Pius	7	1323	7	0.5	7	0.6	0	0	0	0	168	12.7	7.6	0.7
Marcus Aurelius	10	1648	8	0.5	8	0.5	0	0	0	0	57	3.5	2.6	0.2
Commodus	3	1300	4	0.3	4	0.3	0	0	0	0	41	3.2	1.9	0.1
Septimius Severus	7	3387	4	0.1	4	0.1	0	0	0	0	57	1.7	2.6	0.1
Caracalla	2	484	1	0.2	1	0.2	0	0	0	0	5	1	0.2	0
Macrinus	1	33	0	0	0	0	0	0	0	0	0	0	0	0
Elagabalus	2	170	0	0	0	0	0	0	0	0	0	0	0	0
Severus Alexander	5	13451	12	0.1	12	0.1	0	0	0	0	11	0.1	0.1	0

Table 3: summary of Domitianic denarii in coin hoards found in Britain, Domitian to Severus Alexander.



	Domitian	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Caracalla	Macrinus	Elagabalus	Severus Alexander
Period 1	0.1	0.8	0.6	0.6	0.5	0.3	0.1	0.2	0.0	0.0	0.1
Period 2	0.4	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Period 3	0.0	0.8	0.4	0.7	0.2	0.1	0.1	0.0	0.0	0.0	0.0

Figure 2: bar chart displaying the data in table 2. All figures are adjusted percentage proportions.



	Domitian	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Caracalla	Macrinus	Elagabalus	Severus Alexander
Period 3	3.5	41.1	20.1	52.1	24.4	31.7	39.3	18.5	0.0	0.0	4.0
Period 2	71.0	18.6	46.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Period 1	25.6	40.3	33.4	47.9	75.6	68.3	60.7	81.5	0.0	0.0	96.0

Figure 3: 100% stacked bar chart showing adjusted totals of Domitianic denarii of each period as a proportion of all Domitianic denarii (adjusted total) in hoards from Britain, Domitian to Severus Alexander. All figures in percentages.

There is a reasonably large corpus of published silver coin hoards from Britain in the second and early third centuries AD, summarised in Table 3 above. The quantity of evidence available makes a fairly accurate statistical analysis of their contents possible, and any conclusions can be drawn with a degree of confidence. However, it is important to remember that any statistical numismatic study is subject to change as new evidence comes to light, and it is important to take any interpretations with an appropriate pinch of salt.

The 6 recorded hoards in Britain ending with coin of Domitian himself contain several contemporary denarii. Proportionally, the majority of these are those of periods 1 and 2, but this is likely due to the fact that 465 denarii of the 704 recorded in the current dataset come from two hoards, the Skellow and North Suffolk hoards, both of which end with coin of AD 82/83 well before the beginning of the period 3 issue phase. The fact that denarii of all three periods are found in British hoards of Domitian's reign suggests that these coins moved north from Italy reasonably quickly, although the proportional percentage of Domitian's denarii in hoards is lower than that seen in the continental hoards deposited closer to the mint. The largest single group of denarii deposited in Domitianic hoards is that of the fine, heavy period 2 issues, which may suggest some preferential hoarding of these types. However, the difference is very slight and is based on the presence of only 3 denarii out of 704, so it is very difficult to say for certain.

No hoard data is available from Britain for the short reign of Nerva, but that of Trajan demonstrates that the denarii of Domitian moved into the frontier regions reasonably quickly following their issue. Period 2 denarii appear to continue to be hoarded in this period, but their number and proportion in hoards has slightly decreased over the eight years between the last hoard of Domitian and the first of Trajan. This contrasts with the less fine denarii of periods 1 and 3, both of which are hoarded in a much greater proportion than under Domitian himself. However, the small amount of evidence available for the reign of Trajan in Britain renders the accuracy and relevance of these changes minimal.

The evidence for the reign of Hadrian then seem to show a reversal of this trend. The denarii of period 2 make up the single biggest proportional group of Domitianic silver in

hoards, with 5.6 out of the 672.1 denarii after adjustment. This outstrips the denarii of the other two periods, and again suggests preferential hoarding of finer and heavier coins.[180]

This apparent preference for period 2 denarii is all the more significant when it is considered that following the single example included in the Hastings hoard and the two specimens in the Thorngrafton hoard ending with coin of AD 119-122, there are no period 2 denarii in any of the 41 subsequent hoards up to the reign of Severus Alexander included in this case study. The Snettisham 'jewellers' hoard of AD 155, which contains finer denarii which appear to have been selected deliberately for their use as silver bullion, contains 74 period 3 denarii out of a total of 83 silver coins. However, it does not include a single denarius of the even finer period 2 issues, suggesting that these were not available to the hoarder at the time.[181]

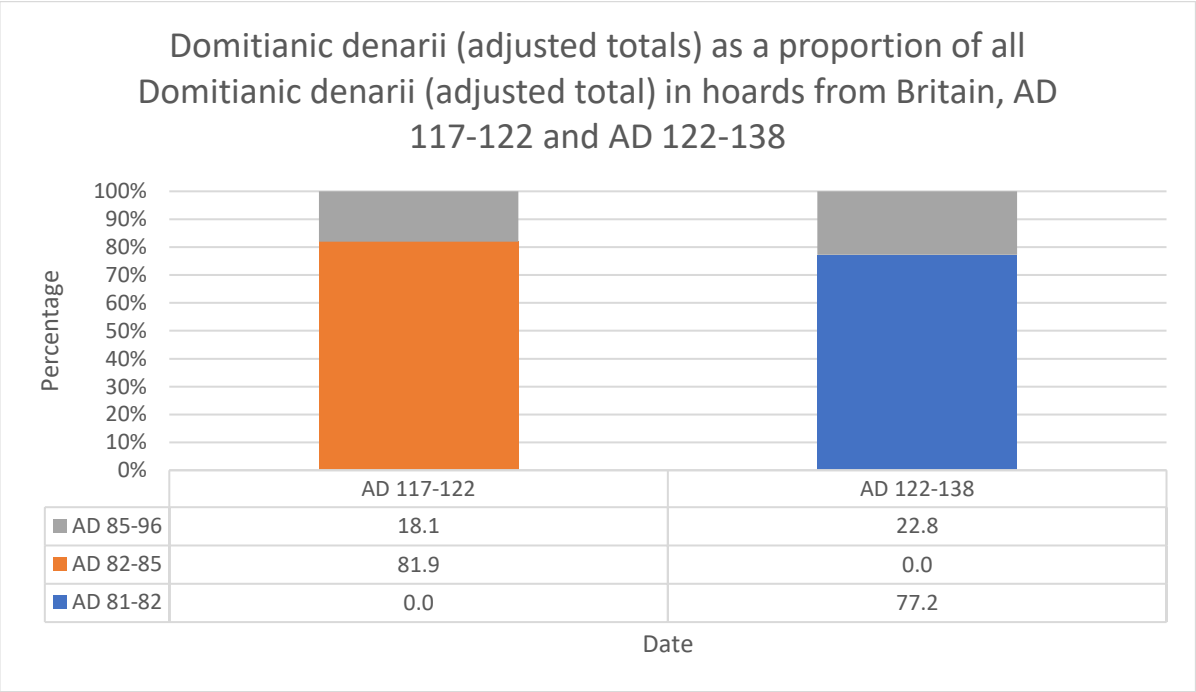


Figure 4: 100% stacked bar chart displaying the adjusted proportion of Domitianic denarii in British hoards ending under Hadrian issued in each issue period. All figures are percentages. Unadjusted total denarii in AD 117-122 hoard = 458. Unadjusted total denarii in AD 112-138 hoards = 269.

This suggests that some mechanism had led to their increased hoarding in the early part of Hadrian's reign, followed by their complete removal from circulation during the early part of the second century. The rapidity and completeness of the removal of certain denarius

[180] However it must be noted that this hypothesis is based on the presence of two additional denarii when compared to the issues of period 1, and the denarii of period 3 are by far the most numerous in simple terms.
[181] Johns (1997) *passim*.

issues suggests state involvement rather than the actions of individual coin users. The stark contrast in the composition of hoards closing prior to AD 122 and those closing afterwards is illustrated in Figure 4. If only the five Hadrianic hoards up to and including the Hastings and Thorngrafton hoards, ending in AD 119-122, are considered, period 2 denarii make up 81.9% of all Domitianic denarii after adjustment, with no period 1 denarii and 18.1% period 3 denarii. The subsequent hoards up to the end of Hadrian's reign then contain no period 2 denarii, but 77.2% period 1 denarii and 22.8% period 3 denarii. The absence of period 1 denarii in hoards from the first phase of Hadrian reign is curious, perhaps indicating that the least fine denarii were deliberately excluded by hoarders interested only in depositing the finest issues. However even after AD 122, only 4 period 1 denarii are recorded. These are all from one hoard, that from Swaby, but as this is by far the largest post-AD 122 Hadrianic hoard then perhaps that is merely a quirk of the other smaller hoards. A date of AD 122 for the removal of period 2 Domitianic denarii would also coincide with the almost complete disappearance of the hitherto-plentiful Republican denarii in circulation[182] as well as early, pre-reform Julio-Claudian coin.[183] All three of these groups were finer and heavier than contemporary denarii, lending further support to the notion that heavier silver was removed from circulation in the first two decades of the second century AD.

The reforms of Trajan, in particular the coinage recall which was noted by Cassius Dio[184] and which has been confirmed by more recent hoard studies,[185] may be the reason for the removal of finer silver issues in the early 2nd century AD. Butcher and Ponting suggest that the Trajanic recall was part of an ongoing series of initiatives designed to stabilise the currency after the reforms of Nero had effectively created two denarius standards circulating concurrently. Domitian originally tried to return to the finer, pre-Neronian standard in AD 82 and then, when this was unsuccessful, debased the coinage and began to recall the heavier and finer pre-reform issues.[186] Domitian's successors then continued this programme until all denarii on the pre-Neronian standard had been removed from

[182] With the exception of the 'legionary denarii' of Mark Antony, which continued to circulate in Britain well into the third century AD; the final major group of Republican coin in the current sample is from the Southants hoard, ending AD 124/128, which has 12 Republican issues from a total of 16 denarii; 2 Republican denarii are also recorded amongst the 83 denarii of the Snettisham hoard ending in AD 155, and 1 Republican denarius is included in the 83 denarii of the Hampstead Marshall hoard ending with a coin of AD 169.
[183] The last examples are found in the Southants hoard of AD 124/128 (2 denarii out of a total of 16), the Middlewich hoard of AD 125 (1 denarius out of 30) and the Potter's Bar hoard of AD 175/176 (1 denarius out of 95), although the last is likely to be anomalous.
[184] Cassius Dio, *Historiae Romanae* 68.15.
[185] For example, see Duncan-Jones (1994) 195-197 and Butcher and Ponting (2015) 459.
[186] Butcher and Ponting (2015) *passim*, esp. 434-460.

circulation. If this analysis is correct then any recall should have taken in the period 2 issues of the Domitianic coinage, which were issued on broadly the same standards as earlier Julio-Claudian denarii. By recalling this newer coinage, the state may have inadvertently advertised its finer quality to attentive coin users. These finer issues would then be the natural choice for hoarding, deposited by the public in the hope of cashing in later on their higher intrinsic value. As Colin Elliot noted, coin users must both be aware of **and** value the difference between various issues in order for Gresham's Law to have an effect in this way. It is possible that, for some, the value differential between Domitianic denarii was not enough to compel them to selectively hoard one group over the others, especially if silver coinage was in short supply. However, it is not unreasonable to suppose that, if presented with the choice and armed with the appropriate knowledge, coin users who were not in dire need of silver coin would choose to retain the most intrinsically valuable issues in hoards.

If correct the above outline would indicate that under certain conditions hoarders may become aware of discrepancies between the intrinsic values of two coinages with the same nominal face value, potentially at a time of coinage recall. This in turn would cause Gresham's Law to come into effect (if coin users valued the discrepancy between intrinsic value and face value and silver coinage was plentiful enough to allow selective hoarding,) with the metallically finer or heavier coinage being rapidly hoarded or otherwise removed before disappearing from circulation.

The subsequent reign of Antoninus Pius shows a decrease in the overall proportion of Domitianic denarii in hoards, likely caused by the removal of period 2 issues from circulation under Hadrian. The relative proportion of period 1 and period 3 denarii remains roughly equal, suggesting that the general public remained unaware of any difference between the two groups. However, the following hoard group, deposited under Marcus Aurelius, does shows a marked decline in the relative proportion of the finer silver period 3 denarii in hoards. Their proportion drops from 0.7% under Antoninus to 0.2% under Marcus, while the denarii of period 1 only decline by 0.1% over the same period. This pattern seems to reverse under Commodus with the proportion of period 1 issues in hoards dwindling by a relatively minor 0.2%, while those of period 3 do not decline at all. The proportion of both groups in hoards then approximately halves under Septimius Severus.

This period of deterioration in the numbers of Domitianic denarii may be linked to coinage reforms carried out by Antoninus Pius and Marcus Aurelius.[187] However the figures for the reign of Antoninus Pius may be unduly influenced by the inclusion of the Snettisham hoard, which as mentioned above includes 74 period 3 denarii out of a total of 83 coins. As this hoard is a clear instance of the preferential inclusion of finer silver coins, it is likely that it is not truly representative of the wider pool of coinage circulating at the time of its deposition. When the Snettisham hoard is removed from consideration, the total number of period 3 denarii is still at its highest under Pius but the proportion of the coins in hoards drops to 0.4%, roughly the same as under Hadrian and lower than the proportion of period 1 denarii. This may then indicate that the relative proportion of period 3 denarii in hoards had declined since the reign of Trajan in comparison with the denarii of period 1, suggesting that the removal of period 3 denarii began much earlier. It should be observed that the Snettisham hoarder did have access to a large quantity of period 3 denarii and therefore, if the date of the final coin can be taken to indicate the date of deposition, the coins must have been in circulation in Britain in reasonable numbers at that time.

Three hoards ending under Pius, those from Londonthorpe, Lawrence Weston and Snettisham, contain significantly higher numbers of the fine silver period 3 denarii than other hoards deposited during his reign. All three hoards end with coin of AD 153/157, dating them to around the time of two reforms of the coinage. The first, in AD 155/156, decreased the silver content of the denarius from around 80% to 74%, while the second in AD 156/157 depleted it yet further to 70%, the standard used up to the reign of Commodus.[188] As noted above the Snettisham hoard may not be representative of wider coin circulation patterns, but the coincidence of these hoards with reforms may indicate some preferential deposition of finer silver coin during a time of coinage debasement, possibly linked to a recall. It is impossible to say without any further corroborating evidence, but it is here noted as another potential example of coinage reforms stimulating public awareness of and concern regarding variations in the intrinsic value of the denarius.

The proportion of all Domitianic denarii in hoards deposited during the sole reign of Caracalla then increases slightly. This apparent revival of Domitianic denarii in hoards may be in part ascribed to inaccuracy due the limited data available for Caracalla's short sole reign when compared to the much longer one of his father. However, it is also possible that

[187] Butcher and Ponting (2012) 72-75.
[188] Butcher and Ponting (2012) 72-74.

the gravity of the so-called 'Great Debasement' of Severus had again drawn attention to the higher value of pre-reform issues when compared to newly-minted coin. Severus appears to have made no changes to the weight of the denarius (in fact he may have increased it after a fall under Commodus), but he decreased the fineness to around 48% in AD 194.[189] When a silver-copper alloy falls to under 90% silver the copper begins to become more visible, eventually leading to a pinkish hue.[190] The state may have masked this through surface depletion and silvering techniques,[191] but wear or damage to the coin may have exposed the more copper-rich heart metal. Increasing public awareness of the lower quality of new denarii may have then led to preferential hoarding of finer silver pre-reform issues, as seen around the time of the other coinage reforms discussed above. However again caution must be used as the hoard sample for Caracalla's sole reign is very small, the variations are fractions of a percent, and any suggestion of change is predicated on the presence or absence of relatively few denarii.

In terms of relative proportions, the denarii of period 1 rapidly outstrip those of period 3 in hoards of this period, a relationship which remains constant throughout the Severan period. Carradice's notes this in his study of Domitianic denarii but does not comment further.[192] It is possible that this increase is attributable to another recall of finer silver denarii occurring around this time, or it may be that public awareness of the higher quality of Domitianic and other pre-reform issues led to the removal of these coins from circulation with the best (i.e. those of period 3) leaving circulation first. Elliot's suggestion that the public availability of professional coin assayers improved at this time, if correct, would also feed into the notion of heightened awareness of inconsistencies in the bullion value of pre- and post- reform denarii.

No evidence is available in Britain for the short reigns of Macrinus and Elagabalus, but the several large hoards of the reign of Severus Alexander shows that the denarii of Domitian had all but left circulation by this time. The only hoard containing any significant numbers of Domitianic coin is that from Shapwick, but even here there is only 21 examples out of 9,262 recorded denarii. In proportional and numeric terms, both adjusted and unadjusted, the majority of Domitianic denarii found in hoards were issued in period 1. This again

[189] Butcher and Ponting (2012) 77.
[190] Ponting (2009) 272.
[191] Butcher and Ponting (2015) 107-110.
[192] Carradice (1983) 70.

indicates that the more numerous period 3 denarii had been preferentially removed from circulation during the early Severan period.

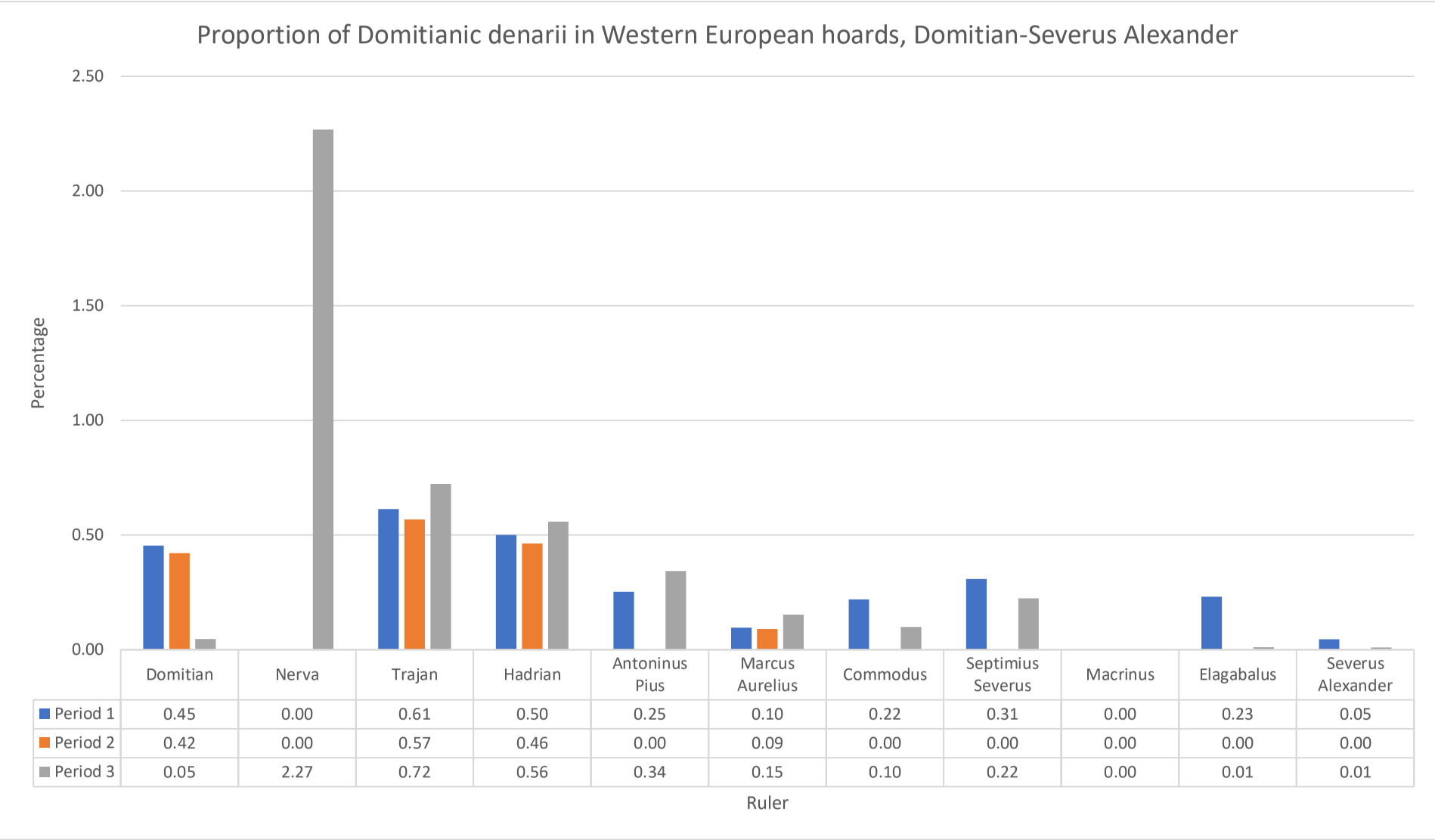
To summarise the hoard evidence from Britain, when issue size is taken into account, period 2 fine silver denarii seem to be hoarded quite heavily up to the reign of Hadrian, then disappear altogether from Antoninus Pius. Period 3 denarii are again quite high, although with a dip under Trajan, before declining very dramatically under Marcus Aurelius and then quite slowly after that. However, when the apparently anomalous Snettisham hoard is removed from consideration, the decline of period 3 denarii appears to start under Trajan, possibly in connection with his coinage reforms and recall. Period 1 denarii are relatively steady, decreasing at a steady rate throughout the period under consideration with the exception of a small increase during the reign of Caracalla.

There does seem to be some awareness that period 2 coins are much finer as they are heavily hoarded before disappearing entirely. This might suggest either a weight increase that made people more aware, active advertisement by the Domitianic authorities of the improvement to the denarius during the years AD 82/85 or a mix of the two. Whether there was any selective hoarding of the finer silver period 3 denarii over the denarii of period 1 is less certain, but this may be made clearer by the study of other provinces. The rapid decline of all Domitianic denarii under Marcus Aurelius and Commodus might suggest recall and reminting in conjunction with reforms from Pius onwards, with the 'Great Debasement' under Septimius Severus speeding up this process. There is also some evidence that the finer silver coins of period 3 were removed first, but again this needs to be examined in contrast with other regions of the empire.

Western Europe

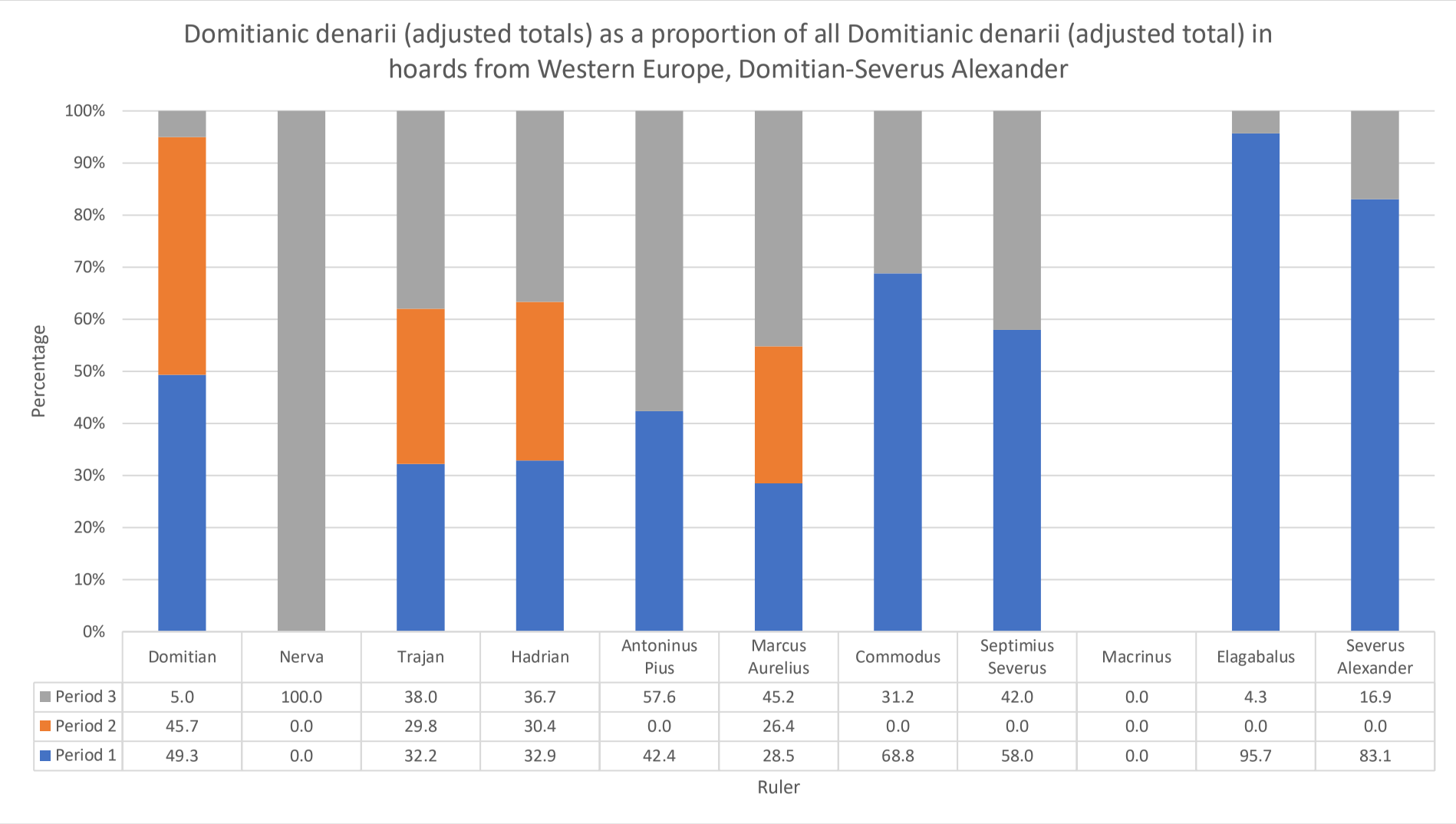
Ruler	Number of hoards	Number of coins	Period 1				Period 2				Period 3			
			Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)
Domitian	6	889	4	0.4	4	0.5	4	0.4	3.7	0.4	9	1	0.4	0
Nerva	1	40	0	0	0	0	0	0	0	0	4	0.9	0.2	2.3
Trajan	4	188	1	0.5	1	0.6	1	0.5	0.9	0.6	26	13.8	1.2	0.7
Hadrian	3	1117	5	0.4	5	0.5	5	0.4	4.6	0.5	123	11	5.6	0.6
Antoninus Pius	5	425	1	0.2	1	0.3	0	0	0	0	30	7.1	1.4	0.3
Marcus Aurelius	4	2133	2	0.1	2	0.1	2	0.1	1.9	0.1	70	3.3	3.2	0.2
Commodus	4	464	1	0.2	1	0.2	0	0	0	0	10	2.2	0.5	0.1
Septimius Severus	4	680	2	0.3	2	0.3	0	0	0	0	32	4.7	1.5	0.2
Macrinus	1	51	0	0	0	0	0	0	0	0	0	0	0	0
Elagabalus	1	867	2	0.2	2	0.2	0	0	0	0	2	0.2	0.1	0
Severus Alexander	11	4365	2	0	2	0	0	0	0	0	9	0.2	0.4	0

Table 4: summary of Domitianic denarii in coin hoards found in Western Europe, Domitian to Severus Alexander



	Domitian	Nerva	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Macrinus	Elagabalus	Severus Alexander
Period 1	0.45	0.00	0.61	0.50	0.25	0.10	0.22	0.31	0.00	0.23	0.05
Period 2	0.42	0.00	0.57	0.46	0.00	0.09	0.00	0.00	0.00	0.00	0.00
Period 3	0.05	2.27	0.72	0.56	0.34	0.15	0.10	0.22	0.00	0.01	0.01

Figure 5: bar chart displaying the data in Table 3. All figures are adjusted percentage proportions.



	Domitian	Nerva	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Macrinus	Elagabalus	Severus Alexander
Period 3	5.0	100.0	38.0	36.7	57.6	45.2	31.2	42.0	0.0	4.3	16.9
Period 2	45.7	0.0	29.8	30.4	0.0	26.4	0.0	0.0	0.0	0.0	0.0
Period 1	49.3	0.0	32.2	32.9	42.4	28.5	68.8	58.0	0.0	95.7	83.1

Figure 6: 100% stacked bar chart showing adjusted totals of Domitianic denarii of each period as a proportion of all Domitianic denarii (adjusted total) in hoards from Western Europe, Domitian to Severus Alexander. All figures in percentages.

The provinces of Western Europe (modern day Spain, Portugal, France, Belgium, the Netherlands, Luxembourg, Switzerland, parts of Germany, Liechtenstein and Italy) individually contain very few well-documented silver coin hoards of the second and early third centuries AD. However, when grouped together enough data can be gathered to produce a reasonable reliable statistical analysis of coin circulation in the area west of the River Rhine. This grouping is to some degree arbitrary and is not intended to reflect divisions in the Roman economy or coinage circulation pool in any way. Where possible differences in hoarding pattern data between smaller sub-divisions of the Western Europe area will be indicated and discussed, and as techniques for hoard recovery and documentation improve it is hoped that enough additional data will become available for the region to allow an examination of circulation patterns at the level of the Roman province.

The hoard evidence for Western Europe is given in Table 4 and Figures 5 and 6 above. As with Britain hoards up to those ending with coin of Severus Alexander are analysed, as all later hoards contain so few Domitianic denarii as to be impossible to study with any degree of accuracy.

The six hoards from Western Europe ending under Domitian contain almost twice as many Domitianic denarii as contemporary hoards from Britain, despite the fact that they contain almost the same total number of denarii. However, this is likely to be linked to the slow speed with which newly minted coin reached the frontiers in Britain when compared to continental Europe, rather than any variance in hoarding preferences. As a proportion of all Domitianic denarii recorded in hoards deposited under Domitian, denarii of period 1 make up about 49%, with coin of period 2 are approximately 46% and period 3 denarii constituting the remainder. The proportion of period 1 denarii in Western Europe is higher than that in Britain, potentially indicating that these coins were preferred for hoarding in continental Europe. The small number of Domitianic denarii in British hoards ending under Domitian makes it difficult to assert this with any degree of certainty, as does the fact that the vast majority of coins in Western European hoards (787 denarii out of a total of 889) appear to have been deposited prior to AD 85, skewing the data in favour of the coin from the first two periods. The proportion of period 2 denarii in both regions is high, indicating that these denarii were in circulation across the area west of the Rhine during the reign of Domitian and in significant enough numbers to be hoarded reasonably well.

The one small hoard of Nerva, from Vilarnovo in north-western Spain, contains a very high proportion of period 3 denarii but none of any other Domitianic issue periods. This suggests that as time went on period 3 denarii became more and more widespread, possibly to the detriment of the denarii of other periods, but the absence of any comparative evidence from Britain or the continent limits the usefulness of this particular hoard.

The total number of recorded denarii hoarded in Western Europe during the reign of Trajan is very small, much lower than that deposited during the reigns of Domitian or Hadrian. As such any analysis needs to be taken with the appropriate degree of caution, but it is possible to note a few trends from the current data. Hoards from Western Europe ending with coin of Trajan contain the peak proportion of Domitianic denarii, as with those from Britain. The proportions of each issue period as a total of all denarii of Domitian in hoards of both regions are roughly similar, with all three denarius groups being hoarded in similar proportions. The only major difference is an apparent lack of period 2 denarii in British hoards when compared to those from the continent, but it must be noted that in both hoard groups there is only a single period 2 denarius.

On the whole it seems likely that the circulation and hoarding of Domitianic denarii under Trajan was broadly similar in both Britain and continental Europe west of the Rhine. Coins of all three periods were hoarded where available, with little apparent preference between the three standards on the part of hoarders. This suggests that the differences in silver content were either largely unknown to the general populace of Britain and the Western Europe area or that they were not substantial enough to spur coin users to action. As a result, it seems that the hoarding of Domitianic denarii was carried out without regard for any variation in their intrinsic values.

This even-handedness seems to continue during the reign of the emperor Hadrian, with denarii of all three periods being hoarded in roughly equal proportions. The denarii of Domitian as a whole proportionally make up around half a percent less of all coins in Hadrianic hoards when compared with those ending under Trajan, potentially indicating that some of them had left circulation during this time. However, this is a very slight difference, and could be in part due to the limited evidence available for the reign of Trajan. The major difference between the hoards of Western Europe and those of Britain is in the denarii of period 2. In Britain these pure denarii make up around 46% of all recorded Domitianic silver coins in hoards, leading to the suggestion that these denarii were being preferentially hoarded at this time, possibly as a response to a recall of fine silver being

undertaken by the imperial authorities. However, in continental Europe, the denarii of period 2 make up approximately 30% of all Domitianic denarii, slightly less than the coin of periods 1 (33%) and 3 (37%). This would suggest little to no preferential hoarding of heavy, fine silver period 2 denarii under the emperor Hadrian in continental Europe west of the Rhine.

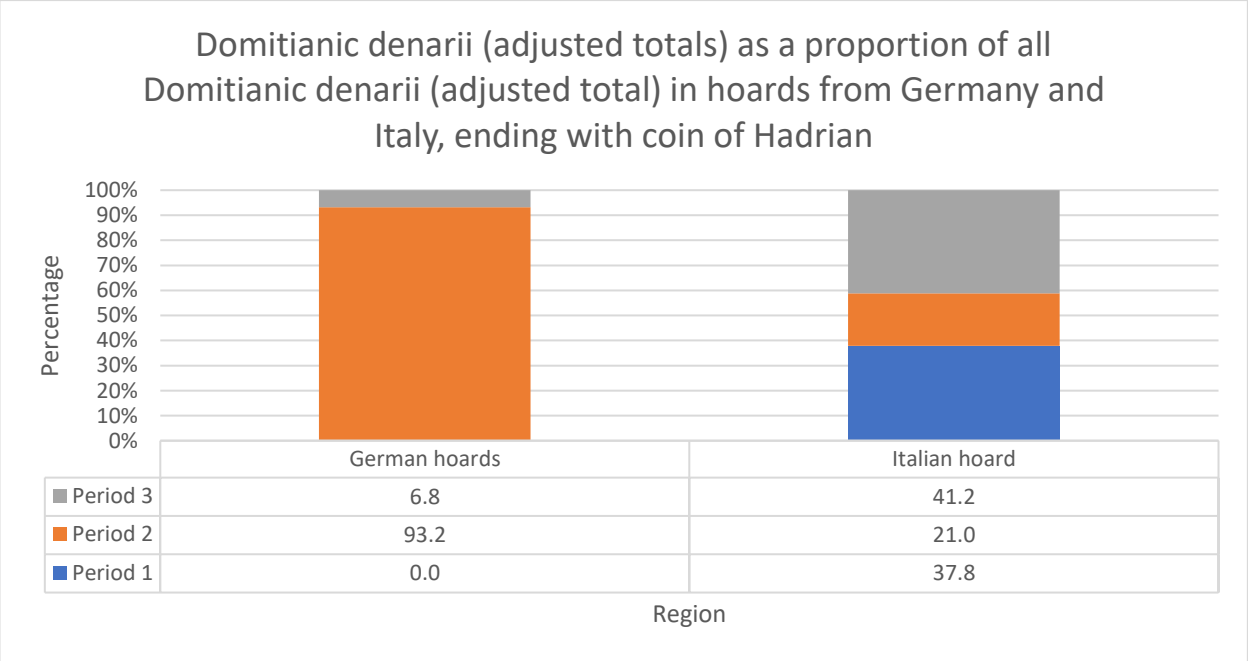


Figure 7: 100% stacked bar chart displaying the adjusted proportion of Domitianic denarii in two German hoards and one Italian ending under Hadrian issued in each issue period. All figures are percentages. Unadjusted total denarii in German hoards = 27. Unadjusted total denarii in Italian hoard = 1,090.

It is possible that there is some regional variation in Europe at this point, illustrated in figure 7. In both small hoards in the current dataset which were deposited in Germany and end with coin of Hadrian no period 1 issues and only three period 3 coins were recorded. However, both hoards contain one coin of the fine silver period 2 denarii, meaning that these coins make up 93.2% of the Domitianic denarii in the hoards after adjustment. In contrast the large Castagnaro hoard from Italy contains roughly equal proportions of all three groups, with a potential slight preference for the issues of periods 1 and 3. This may indicate some preferential hoarding of the finest denarius issues on the Rhine frontier, similar to earlier Hadrianic hoards in Britain, while the evidence from Italy would suggest that hoarders there were unaware or had no preferences. The very small number of coins in the two German hoards makes it difficult to say this with any degree of certainty, and the German Gauting 2 hoard ends in AD 134/138, well after the proposed removal of period 2 denarii from circulation in Britain. Likewise, the fact that all the evidence for Italy

for this period comes from a single hoard also casts doubt on any conclusions. It is possible that hoarders in the frontier provinces of the empire were more aware of or concerned about the fineness of individual denarius issues than others. As more evidence becomes available it may be possible to review this point, but for now it can merely be noted.

The Western European hoard data for finds ending during the reign of Antoninus Pius is broadly similar to that from Britain. The denarii of period 2 are absent, indicating that they may have been removed from circulation in line with the hoard evidence from Britain. The denarii of periods 1 and 3 are present in roughly equal proportions, suggesting no preferential hoarding of one group over the other and therefore no awareness of the higher intrinsic value of period 3 denarius issues. The only major difference is a marked decline in the total proportion of Domitianic denarii in hoards, which falls from around 1.5% to around 0.5%. A decline is also seen in Britain, but this takes place more gradually between the reigns of Hadrian and Marcus Aurelius and may be ascribed, at least in part, to the constant gradual decay in the size of coin populations caused by wastage and loss. On the other hand, the sudden drop seen in Western Europe may indicate some kind of withdrawal of the denarii of Domitian from circulation, especially evident for the finest silver period 2 issues which are completely absent in Antonine hoards.

The reason for this potential withdrawal of coin is more difficult to pinpoint. The speed and suddenness of this decline in Western Europe suggests some official involvement in this recall, and it is possible that this was part of the general removal of fine silver denarii which had been taking place since the time of Domitian himself. Unusually high levels of hoarding of period 3 denarii were noted in British hoards ending around the time of Antoninus' coinage debasements in AD 155/157, leading to a suggestion that reforms under Antoninus could have stimulated change in circulation patterns. However, all of the Western European hoards of Antoninus Pius end with coin which date before these reforms, so it is difficult to ascertain what effects (if any) they had in Western Europe or to ascribe the decline in the numbers of Domitianic denarii to them.

Of course, it is also possible that any change in the proportion of Domitianic denarii is down to the reliability of the evidence, especially considering that the Antonine hoards under discussion are relatively small. However, the drop in the number of Domitianic denarii in Western European hoards continues under Marcus Aurelius, albeit at a much slower pace. The most interesting find in the hoard data for this period is the find of two period 2 denarii, alongside 2 of period 1 and 66 of period 2, in the large Stockstadt II hoards ending

AD 164/169. However, these denarii are entirely absent in all other hoards from Antoninus Pius onwards in both Britain and Germany, so their inclusion in this hoard is likely an anomaly which does not reflect circulation patterns in western continental Europe or elsewhere. The relative proportions of both period 1 and period 3 denarii remain approximately the same, suggesting a continuation of the indifference of hoarders to the remaining stock of Domitianic silver.

The proportional decline in the denarii of Domitian in hoards of Western Europe appears to have been arrested by the reign of Commodus. The proportion then actually increases quite dramatically under Septimius Severus, to levels which had not been seen in the area since the reign of Antoninus Pius. This increase may mirror one which can be seen in Britain, although it starts much earlier (under Commodus as opposed to during the reign of Caracalla only in Britain) and is more substantial (by almost 0.3% instead of less than 0.1% in Britain). As a proportion of all Domitianic denarii in hoards, the finer silver denarii of period 3 seem to experience a small increase in their number in hoards when compared to the baser period 1 denarii. This contrasts with the decline in the relative proportion of period 3 denarii in the British hoards deposited under Caracalla, when Domitianic denarii were increasing as a proportion of all coins in hoard.

Carradice notes an increase in the proportion of denarii minted between AD 88-89 in central and eastern European hoards from the reign of Nerva to that of Septimius Severus before a decline following his coinage reforms. He attributes this increase to a possible return of fine silver coinage which had been shipped beyond the frontiers to the empire following the improved integration and stabilisation of the Danubian provinces.[193] If this is a correct analysis, it is possible that the same occurred on the Rhine. Fine silver coin may have gravitated towards the frontier, passing back and forth over it for reasons such as trade or subsidies to barbarian tribes. Perhaps the enforcement of the face value of coinage was not as prominent on the frontiers, so interested parties moved coin with a high bullion value there in order to benefit? It is also possible that these superior silver issues were deliberately selected for hoarding during a period of decreasing silver fineness in the late second and early third centuries. Further comparison with other regions will be required in order to confirm or deny the existence of a proportional increase of period 3 denarii in hoards ending under Commodus and Septimius Severus. However, it does seem

[193] Carradice (1983) 73-74.

that some selective hoarding of fine silver Domitianic denarii may have occurred in Britain and Western Europe at the end of the second century AD.

No hoards of the sole reign of Caracalla from Western Europe are currently available for analysis, and the one small hoard ending with coin of Macrinus contains no Domitianic issues. The more substantial Obererbach hoard, ending with denarii of Elagabalus dated to AD 218/222, contains 2 denarii each of period 1 and period 3, suggesting that the finer silver coin of AD 85-96 had suffered a serious decline in numbers following the reforms of Severus. This is borne out by the much more substantial evidence available for the reign of Severus Alexander, where of 4,365 coins recorded in the current dataset only nine are denarii of period 3 and two are issues of period 1. Seven of the period 3 denarii are found in one hoard (that from Baden-Baden), while both period 1 issues are from the Welzheim hoard. The hoard evidence therefore suggests that the denarii of Domitian had ceased to circulate widely, or even at all, during the latter Severan period. This disappearance is likely linked to the Severan reforms and the preferential removal of finer pre-Severan reform denarii from circulation, either by the state or by individuals. This suggests some level of cognizance of the differing values of various denarius issues, most likely by the state who would of course be aware that contemporary silver had been debased. The fact that the issues of period 1 and 3 seem to leave circulation at roughly the same time perhaps indicates a lack of knowledge of the fine details of earlier reforms, with the actors who removed the coinage simply lumping together 'pre-reform' and 'post-reform' issues.

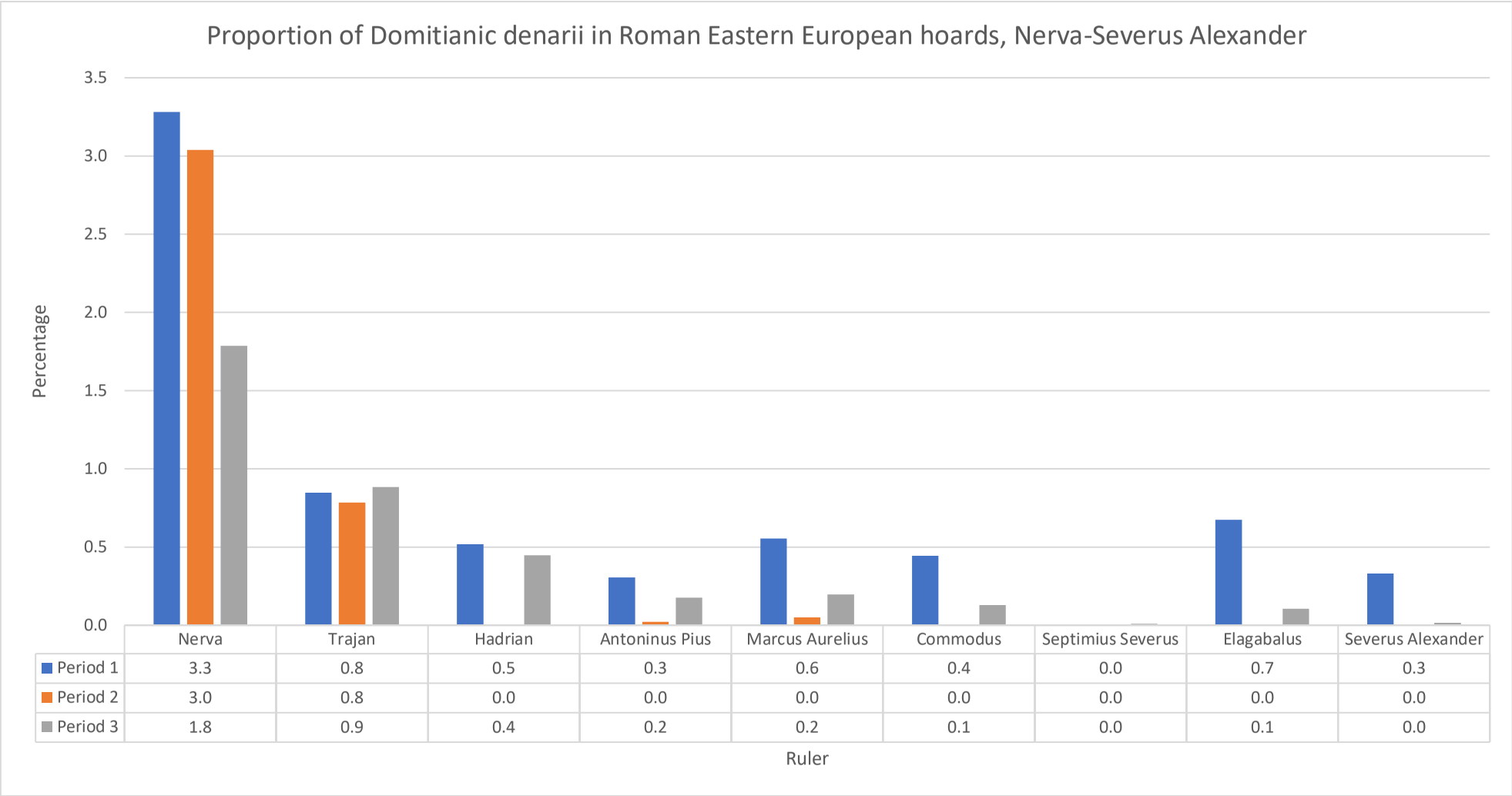
To conclude the review of Domitianic denarii in hoards of Western Europe, the data appears to be roughly similar to that from Britain. Period 2 denarii are hoarded quite heavily up to the reign of Hadrian before disappearing (with the exception of one likely anomalous denarius deposited under Marcus Aurelius.) Period 3 denarii decline rapidly from the reign of Antoninus Pius onwards, while the denarii of period 1 diminish at a slow but steady rate. A dramatic increase in the number of Domitianic denarii, especially those of period 3, can be seen in the hoards ending during the reign of Septimius Severus, likely linked to his reforms of the silver coinage. However, the denarii of Domitian then continue to leave circulation until their numbers are negligible in the time of Severus Alexander. This mirrors, with some variation, the picture given by the British evidence, with changes in hoarding patterns generally taking place around the time of reforms to the coinage. This suggests that, in north-western Europe at least, that awareness of the difference in intrinsic values of different coin groups was generally low up until the implementation of coinage reforms. Why knowledge of reforms became public is unknown, although it may be that

the state advertised certain changes (probably only improvements) for propaganda purposes or undertook recalls of finer issues which alerted the public to their value.

Eastern Europe

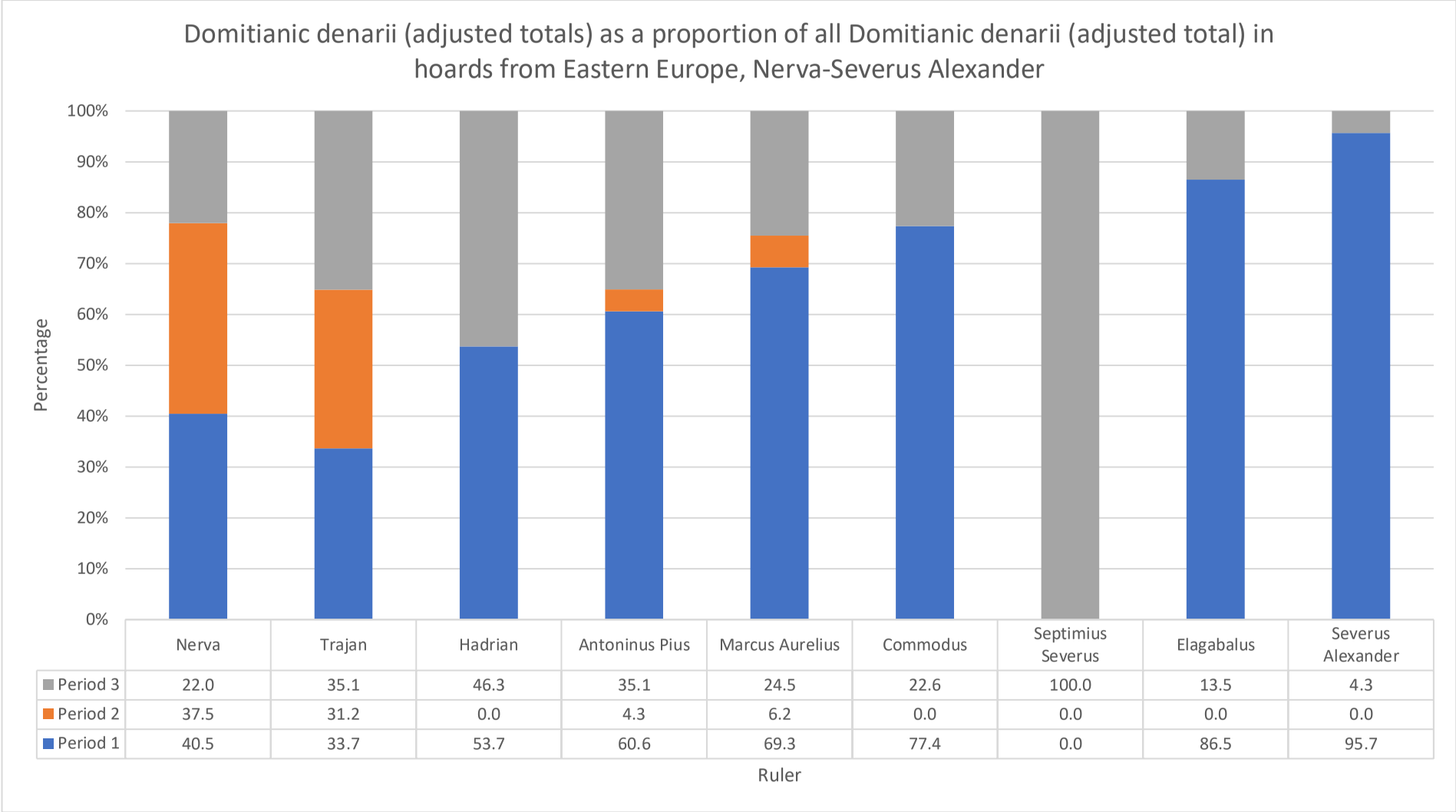
Ruler	Number of hoards	Number of coins	Period 1				Period 2				Period 3			
			Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)
Nerva	1	42	1	2.4	1	3.3	1	2.4	0.9	3.0	12	28.6	0.5	1.8
Trajan	1	140	1	0.7	1	0.8	1	0.7	0.9	0.8	23	16.9	1.0	0.9
Hadrian	3	1055	5	0.5	5	0.5	0	0	0	0	95	9.0	4.3	0.4
Antoninus Pius	5	4414	13	0.3	13	0.3	1	0	0.9	0	166	3.8	7.5	0.2
Marcus Aurelius	10	5823	31	0.5	31	0.6	3	0.1	2.8	0	242	4.2	11	0.2
Commodus	6	2079	9	0.4	9	0.4	0	0	0	0	58	2.8	2.6	0.1
Septimius Severus	3	442	0	0	0	0	0	0	0	0	1	0.2	0	0
Elagabalus	1	1364	9	0.7	9	0.7	0	0	0	0	31	2.3	1.4	0.1
Severus Alexander	5	1514	5	0.3	5	0.3	0	0	0	0	5	0.3	0.2	0

Table 5: summary of Domitianic denarii in coin hoards found in Roman Eastern Europe, Nerva to Severus Alexander (no data available for the reign of Domitian



	Nerva	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Elagabalus	Severus Alexander
Period 1	3.3	0.8	0.5	0.3	0.6	0.4	0.0	0.7	0.3
Period 2	3.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Period 3	1.8	0.9	0.4	0.2	0.2	0.1	0.0	0.1	0.0

Figure 8: bar chart displaying the data in Table 4. All figures are adjusted percentage proportions.



	Nerva	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Elagabalus	Severus Alexander
Period 3	22.0	35.1	46.3	35.1	24.5	22.6	100.0	13.5	4.3
Period 2	37.5	31.2	0.0	4.3	6.2	0.0	0.0	0.0	0.0
Period 1	40.5	33.7	53.7	60.6	69.3	77.4	0.0	86.5	95.7

Figure 9: 100% stacked bar chart showing adjusted totals of Domitianic denarii of each period as a proportion of all Domitianic denarii (adjusted total) in hoards from Eastern Europe, Nerva to Severus Alexander. All figures in percentages.

The hoard evidence for Eastern Europe (the region of the Roman Empire west of the Rhine and south of the Danube, including parts of modern-day Hungary, Romania, Serbia, Slovenia and Bulgaria) for the period under discussion is substantial. However, determining which hoards come from inside the empire and which outside is more difficult, as the border in this area shifted considerably over time and it is not always clear exactly where the frontier was. Up to the reign of Trajan the western and southern banks of the Danube generally marked the boundary of the Empire. Following the Dacian Wars of AD 101-102 and AD 105-106, large parts of the former Dacian kingdom north of the Danube were captured and turned into two (later three) provinces. These new conquests stretched east to the area around the modern border with Hungary, north to the ancient city of Porolissum near the modern Romanian town of Zacau, and west to the Carpathian Mountains. These provinces remained more or less under Roman control until the reign of the emperor Aurelian, when they were abandoned to encroaching Dacian tribes in around AD 271. These boundaries, although quite vague and open to criticism, will be the ones used to determine whether hoards are inside or outside the boundaries of the empire throughout this thesis.

There is no data for the reign of Domitian, and very little for those of Nerva and Trajan. However, this is perhaps to be expected as the most comprehensive hoard records for Eastern Europe come from Romania, which was not part of the Empire until AD 106. Otherwise the number of hoards and denarii under consideration is robust enough evidence to allow statistical analysis and comparison with records from other regions. The data for Eastern Europe is summarised in Table 5 and is visualised in Figures 8 and 9.

The small hoard ending with coin of Nerva contains a proportionally large amount of all three groups of Domitianic denarii, with a slight bias towards coin from the earlier part of his reign (perhaps because new denarii had not had time to reach the frontier). The larger hoard deposited during the reign of Trajan seems more similar in composition to those from Britain and Western Europe, with approximately equal proportions of all three groups of Domitianic denarii present. The much more substantial hoard evidence for the reign of Hadrian continues the pattern seen in other regions and demonstrates a significant change in coinage circulation in the area at this time. The total proportion of Domitianic denarii in hoards is substantially less than previous reigns and is around half a percent lower than hoards from Britain and Western Europe. Denarii of period 1 and 3 are found in almost equal adjusted proportions, but the denarii of period 2 are again completely absent. As in

Britain, this decline in the numbers of the purest silver Domitianic coin coincides with a drastic decrease in the proportion of Republican denarii and the complete removal of pre-AD 64 Julio-Claudian denarii from circulation.

Again, then it seems that the finest Domitianic issues were removed from circulation alongside other pure silver issues in Eastern Europe, as part of a process of recall and reform of the denarius under the emperors Domitian, Nerva and Trajan. However later hoard evidence would indicate that this recall was much less thorough in Roman Eastern Europe than in other areas. Hoards deposited under the next two emperors, Antoninus Pius and Marcus Aurelius, contain some denarii of the fine silver period 2 issues. Unlike the apparent survival of period 2 denarii to the reign of Marcus Aurelius in Western Europe, which is actually only two denarii in one hoard, a single denarius is found in four separate hoards (one under Antoninus and three under Marcus). The small number of these denarii mean it is impossible to say for certain exactly what was happening, if indeed there was any difference. However, their very presence in hoards deposited at a point where the finest and heaviest denarii had all but vanished from hoards recorded elsewhere in Europe suggests significant variation between coin circulation patterns on the Danube and those elsewhere. Adding to this hypothesis is the fact that small but reasonable numbers of Republican denarii are also found in hoards of this period, when again they had all but disappeared in deposits recorded further west.

To turn to the other two groups of Domitianic denarii, from the time of Hadrian onwards the issues of period 3 decline as a proportion of all Domitianic denarii and are rapidly eclipsed by those of period 1. This suggests that the finer period 3 denarii are being slowly but surely removed from circulation, possibly as a consequence of their higher silver content than most denarii issued in the second and third centuries AD.

In contrast the less fine denarii of period 1 actually seem to increase as a proportion of all denarii in hoards from the reign of Antoninus Pius onwards (with the exception of the hoards of Septimius Severus as discussed above). This is similar to the late second century increase seen in the other two areas discussed thus far, although it begins earlier and is much more sustained. As discussed above, this change in hoarding patterns may be a response to the Antonine and Severan coin debasements, with finer silver issues being hoarded as a store of wealth. However, the long period of time for which this increase occurs suggests that this was not a one-off period of rapid hoarding of particular issues. It may instead suggest that the number of Domitianic denarii in circulation in the Eastern

European provinces was increasing, and therefore that more were available to hoard. Why this would occur is uncertain, although it is also possible that it is a result of coinage reforms. Prices on the frontier would potentially be more open to the influence of metallism due to a lack of enforcement of face values, and so the higher silver content of Domitianic denarii would have greater purchasing power in these regions that elsewhere. The similar, if later, increases in the number of Domitianic denarii in other frontier hoards on the Rhine and in Britain may also have been linked to this effect. However, it is difficult to assert with any certainty and is here presented as a tentative hypothesis.

The lack of data for the reign of Septimius Severus in Eastern Europe, especially when compared to the much larger groups from Britain and Western Europe, is in itself interesting. There is a large number of hoards containing around 7,000 denarii and ending with coin of Septimius Severus recorded in the current dataset from beyond the Dacian frontier, which may indicate a possible movement of coin outside the empire at this time in response to the Severan Great Debasement. This will be discussed in further detail below.

The latest hoards in the current dataset, when compared with those from Britain and Western Europe, still contain reasonably large numbers of Domitianic coin. This again may lend support to the theory that the mechanism for coin removal, whether state recall or private initiative, did not operate as effectively at this time. However, the proportion of fine silver denarii does not increase at this time, it merely does not diminish as fast as in other areas, and no similar trend can be seen on the other frontiers in Britain and on the Rhine.

To summarise then, the trends in hoarding patterns of Domitianic denarii seen elsewhere are more or less still observable in Roman Eastern Europe. Proportions of each group of denarii are roughly equal in the small hoards of Nerva and Trajan, with none of the three groups seeming to be hoarded preferentially. During the reign of Hadrian all period 2 denarii disappear from hoards alongside most Republican and pre-AD 64 Julio-Claudian denarii, in a pattern also seen elsewhere. This indicates a concerted effort to remove fine silver from circulation, while the speed at which this occurs would suggest some kind of state initiative and therefore some official knowledge of which issues were finer than others. However, the role of the general public cannot be ruled out, nor can a combination of the two agencies.

In a departure from the evidence from the western regions, in Eastern Europe the removal of finer coin does not seem to have been as thorough with one period 2 denarii appearing

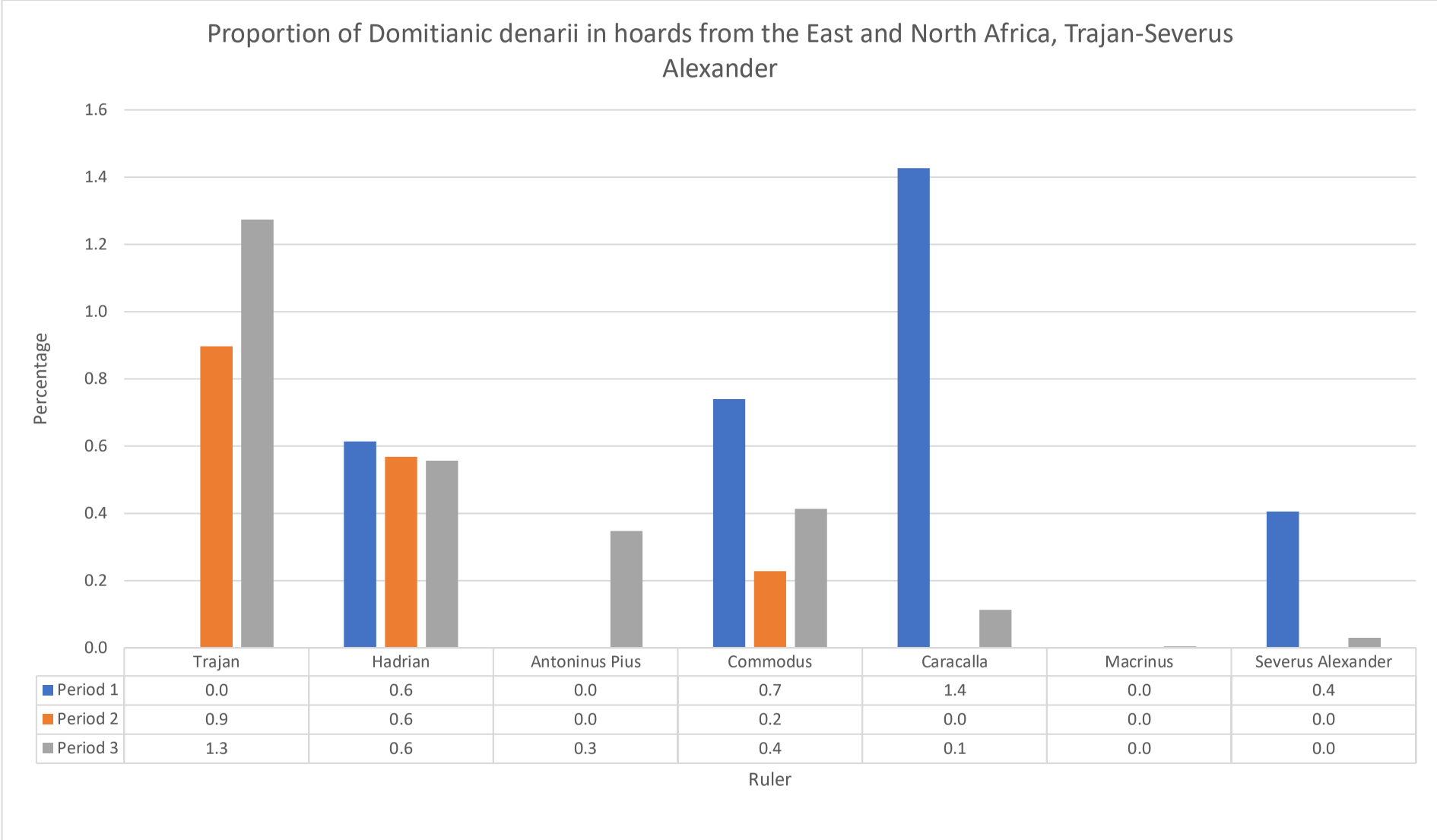
in one hoard under Antoninus Pius, then single finds in four hoards ending with coin of Marcus. Republican and early Julio-Claudian coin are also found in decent, if much reduced, numbers in hoards from the reign of Hadrian up to the reign of Marcus Aurelius, supporting the notion of a less comprehensive removal of fine silver denarii in Eastern Europe.

Of the other two groups, the adjusted proportion of period 3 denarii declines slowly from the time of Hadrian onwards, being eclipsed by the denarii of period 1 in all subsequent hoards. The seems to be little evidence preferential hoarding of period 3 denarii under Septimius Severus as seen in other regions, but it is possible that the denarii of period 1 were being selected for movement to the Danube frontier in the later second and early third century. Domitianic denarii, largely those of period 1, still form a statistically significant proportion of coin under Severus Alexander, at a time when they have been all but removed from hoards in Western Europe and Britain. Yet again this may suggest that the mechanism by which these coins were removed from circulation was operating more slowly on the Danube frontier than it was elsewhere.

The East and North Africa

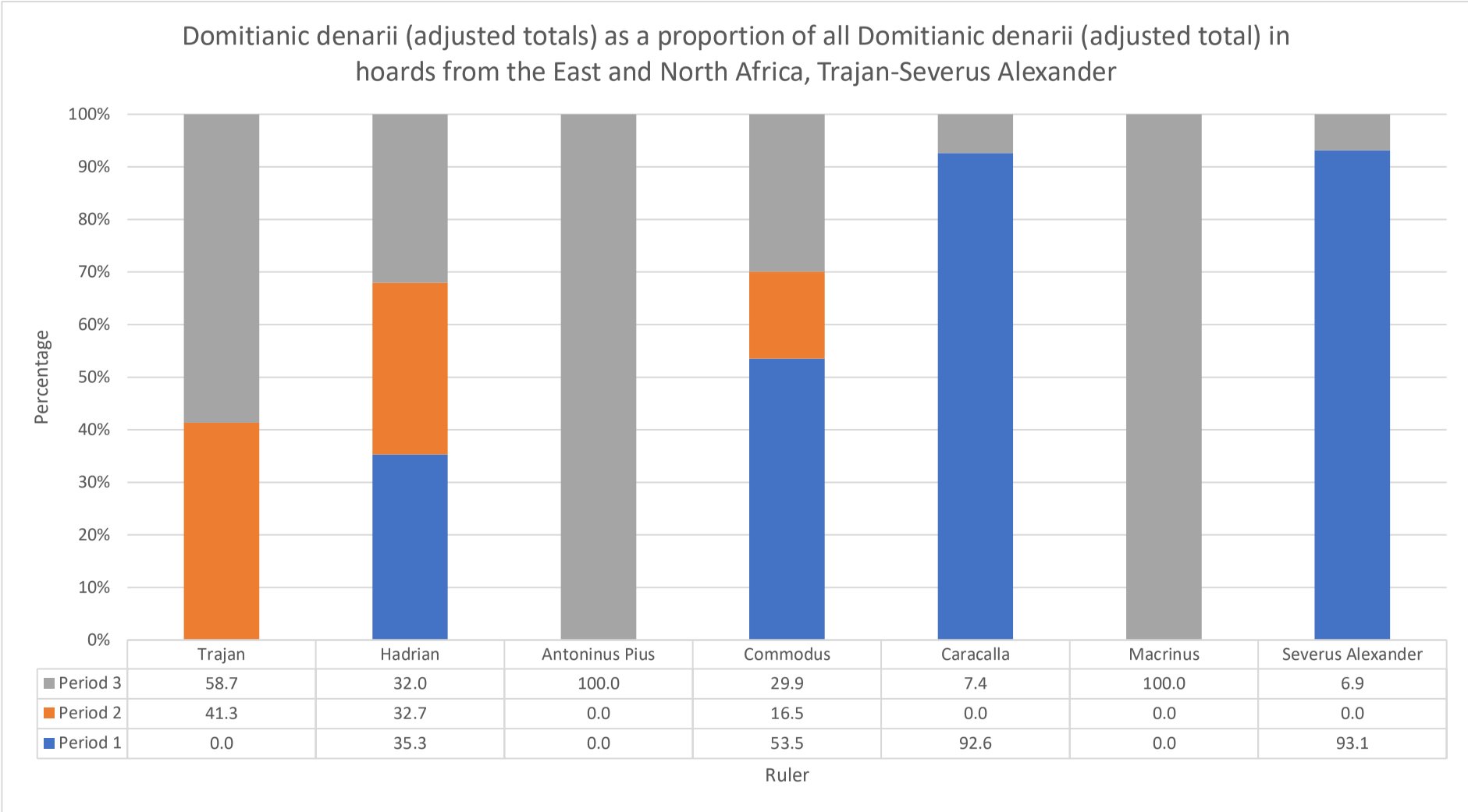
Ruler	Number of hoards	Number of coins	Period 1				Period 2				Period 3			
			Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)
Trajan	1	262	0	0	0	0	2	0.8	1.9	0.9	58	22.1	2.6	1.3
Hadrian	4	364	2	0.5	2	0.6	2	0.5	1.9	0.6	40	11	1.8	0.6
Antoninus Pius	1	84	0	0	0	0	0	0	0	0	6	7.1	0.3	0.3
Commodus	1	441	3	0.7	3	0.7	1	0.2	0.9	0.2	37	8.4	1.7	0.4
Caracalla	1	287	4	1.4	4	1.4	0	0	0	0	7	2.4	0.3	0.1
Macrinus	1	376	0	0	0	0	0	0	0	0	2	0.1	0.1	0
Severus Alexander	1	1984	8	0.4	8	0.4	0	0	0	0	13	0.7	0.6	0

Table 6: summary of Domitianic denarii in coin hoards found in the East and North Africa, Trajan to Severus Alexander



	Trajan	Hadrian	Antoninus Pius	Commodus	Caracalla	Macrinus	Severus Alexander
Period 1	0.0	0.6	0.0	0.7	1.4	0.0	0.4
Period 2	0.9	0.6	0.0	0.2	0.0	0.0	0.0
Period 3	1.3	0.6	0.3	0.4	0.1	0.0	0.0

Figure 10: bar chart displaying the data in Table 5. All figures are adjusted percentage proportions.



	Trajan	Hadrian	Antoninus Pius	Commodus	Caracalla	Macrinus	Severus Alexander
Period 3	58.7	32.0	100.0	29.9	7.4	100.0	6.9
Period 2	41.3	32.7	0.0	16.5	0.0	0.0	0.0
Period 1	0.0	35.3	0.0	53.5	92.6	0.0	93.1

Figure 11: 100% stacked bar chart showing adjusted totals of Domitianic denarii of each period as a proportion of all Domitianic denarii (adjusted total) in hoards from the East and North Africa, Trajan to Severus Alexander. All figures in percentages.

The vast majority of circulating silver coinage in the Roman Near East and Egypt during the time period under consideration was the locally produced 'provincial coinage,' discussion of which lies outside the scope of this thesis. The other area of the north African coast also contains very few well-recorded denarius hoards, but whether this is due to limited monetisation of the area or a lack of historiographic tradition of hoard recording is unknown. A few denarius hoards, or 'provincial' hoards containing denarii, have been recorded in both regions, but the chronological record is not detailed enough to allow the creation of a narrative analysis of the circulation of Domitianic denarii as above. However, there is enough to examine, with the appropriate caution, whether the circulation patterns of the Domitianic denarii which did make it to the East were significantly different to those seen in western regions.

No hoards in the current data set end with coin of Domitian himself or his successor Nerva, but the Sakha hoard from the Nile Delta ends with an issue of AD 114/117 towards the end of Trajan's reign. This reasonably large hoard contains 262 'imperial' denarii alongside 33 Greek silver coins and 5 Roman 'provincial' issues. Amongst the 262 denarii are sixty issued by Domitian, and of these two are of the finest period 2 issues with the remainder being minted during period 3. Following adjustment for issue size, the denarii of period 3 make up 10.7% of all coin in the Sakha hoard while those of period 2 are 0.4%. The proportion of period 2 denarii in the Sakha hoard is the same as that found in British hoard, and slightly less than in hoards of western and eastern Europe (both 0.8%). The complete lack of the least fine period 1 denarii, which make up 0.8% of contemporary British and eastern European hoards and 0.6% of those from western Europe, is perhaps noteworthy. However, it must be remembered that 4 out of 5 of the British hoards and 2 out of the 4 European hoards ending under Trajan also contain no period 1 denarii, so the lack of these coins may just be a vagary of the available evidence in this region.

What is more interesting is the very high number of period 3 denarii in the Sakha hoard, which if the hoard is assumed to have been buried at around the time of its latest coin, would have had only a relatively short time to make the journey from the Roman mint to the coast of Egypt. The 10.7% adjusted proportion is much bigger than the 0.8% seen in Britain and western Europe and the 0.9% in the single hoard of Eastern Europe. It is possible that this hoard may represent some preferential selection of these issues, which although not the purest or heaviest were considerably finer than the majority of coin issued by Nero, Vespasian or Titus. The date of the hoard, following the reforms of Trajan in the earlier part of his reign, may suggest a link between the two events. Perhaps the

recall of coinage preceded Trajan's reforms indicated the higher intrinsic value of certain issues, and thus prompted the owner of the Sakha hoard to collect those coins and store them? Without any corollary evidence it is impossible to say, although it should be noted that an increase in the number of period 2 and 3 issues was also seen in the hoards of mainland Europe and Britain.

4 hoards from the reign of Hadrian are included in the current analysis, those from Volubilis in Morocco, Murabba'at and Eleutheropolis in Israel and Hebron in Palestine. Collectively these hoards contain 364 denarii, a much smaller sample size than the other regions under consideration but large enough to make some comparisons. Two denarii each of periods 1 and 2, and forty of period 3 are present in these hoards, with each group making up 0.6% of hoarded denarii overall after adjustment for issue size. This balance is striking, suggesting little to no preferential hoarding of any issue of Domitianic denarii and contrasting greatly with the large proportion of period 3 coin seen in the Sakha hoard. This perhaps indicates that the Sakha hoard is exceptional and reinforces the need to treat any analysis of it with caution. When compared with other regions, the Eastern and North African Hadrianic hoards contain similar proportions of Domitianic denarii to the British and European samples (with the contrast to the complete lack of period 2 denarii in Eastern European hoards discussed above). One interesting point of distinction is the continuing presence of a small number of Republican denarii in three of the four hoards, at a time when they had all but disappeared from Britain and Western Europe. This could indicate that the Eastern and African provinces saw a reduced effort to remove finer silver denarii from circulation in a similar manner to that seen on the Danube and discussed above. However, four of the five Republican coins come from the Volubilis and Murabba'at hoards which end with issues of AD 119/122, before the suggested date of AD 125 for the complete removal of Republican issues in Britain. No pre-AD 64 Julio-Claudian issues, of similar fineness and weight to Republican coin, are recorded in any hoards from the East at all, further limiting the strength of this proposition.

The one small hoard ending with an AD 143 issue of Antoninus Pius in the current dataset, from Tipasa in modern Algeria, contains six period 3 denarii out of 84 total coins, equating to 0.3% of the total after adjustment. However, no further comment can be made, as the very small size of this single hoard restricts its usefulness unless more corroborating data becomes available.

No evidence for the reign of Marcus Aurelius is presently available but the large Larnaka hoard from Cyprus, ending in AD 183/184, provides some for his successor Commodus. This hoard of 441 denarii contains three coins of period 1, one of period 2 and thirty-seven of period 3. Following adjustment, Domitianic coins of the three periods make up 0.7%, 0.2% and 0.4% of the sample respectively. The continued presence of a denarius of period 2 may again suggest a more limited withdrawal of fine silver in the Eastern provinces, although the small sample size prevents asserting this with any certainty. The increase in the proportion of period 1 denarii indicates a shift, seen in the other regions at around this time, to a preference for hoarding less fine early Domitianic issues over their finer successors. It must be noted though that the number of period 3 denarii is still considerable and represents a slight increase on the adjusted proportional total seen in the small Tipasa hoard ending under Antoninus Pius.

The Ain-Temouchent hoard of 287 denarii from Algeria ends during the sole reign of Caracalla, with a denarius of AD 215. Four of the denarii were issued during Domitianic period 1 (1.4% after adjustment) while 7 were issued in period 3 (0.1% after adjustment). The proportional figures cement the impression of a decline in the number of period 3 denarii in circulation following the reforms of the late second and early third centuries, as seen elsewhere. The hoard also contains 80 'legionary denarii' of Mark Antony, a very large number for such a late date but not incomparable with similar hoards from Britain. However, the presence of 13 earlier fine silver Republican denarii is of more interest, as they had all but left circulation in the European regions of the Empire by this point. This may suggest that the Ain-Temouchent hoard was built up over a considerable period of time and therefore is not representative of the coinage in circulation in North Africa during the reign of Commodus. It could also indicate the possibility that the removal of earlier, finer silver coins had not been particularly thorough and the hoarder, when he acquired them, was able to identify and retain the better-quality issues. Again, without comparative evidence it is impossible to say with any certainty, although it remains an interesting question worthy of further examination.

The slightly later Dura Europos hoards 3 and 4, ending under Macrinus in AD 218, contain only two Domitianic denarii of period 3 out of a total of 376 'imperial' issues. This further strengthens the notion that fine silver coin was selectively removed from circulation following the Severan reforms, as seen in hoard evidence in Europe and Britain, a proposition lent further weight when the very large Tell Kalak hoard of AD 222 is taken into consideration. This hoard contains 1,984 recorded 'imperial' denarii (alongside 365

‘provincial’ silver issues), of which only 21 were issued during the reign of Domitian. Of these, 8 are coin of period 1 (making up 0.4% of the hoard after adjustment) while 13 are those of period 3 (less than 0.1% of the hoard). It is clear that the finest remaining silver coins issued by Domitian were in severe decline by this time, especially when compared to the earlier, less fine issues of the same emperor. This may suggest a preference on the part of the agency responsible for removing coin from circulation for those issues with higher intrinsic value, although it must again be noted that by this time even the denarii of period 1 were considerably finer than contemporary coin.

In conclusion, the very limited evidence available for the Eastern and Northern African provinces suggests that the circulation pattern of Domitianic denarii did not vary substantially from that seen in Britain or mainland Europe. The fact that the imperial denarius was not the preferred silver coinage across large tracts of this region alongside the lack of extant hoard evidence means that any conclusions drawn in this section are tentative. However, the available data does not directly contradict that discussed so far for Britain and Europe in any major way. All issues are hoarded well in the first couple of decades of their existence, followed by a steady decline from the reign of Trajan onwards. The finest silver period 2 issues are the first to go, no longer hoarded following the reign of Hadrian with the exception of a single example in the Larnaka hoard ending under Commodus. This suggests that the public may have been aware of the intrinsic values of these coins, for several potential reasons which have been discussed above. The less fine denarii of period 3 then suffer a comparative proportional decline when compared to the least fine issues of period 1, again as seen in other regions. The continuing presence of some Republican issues well into the second century may suggest a similar delay to that seen in Eastern Europe of the removal of the finest silver coin in the area, perhaps suggesting that knowledge of the intrinsic value of coinage was not as complete or that the will to remove these issues was not as strong.

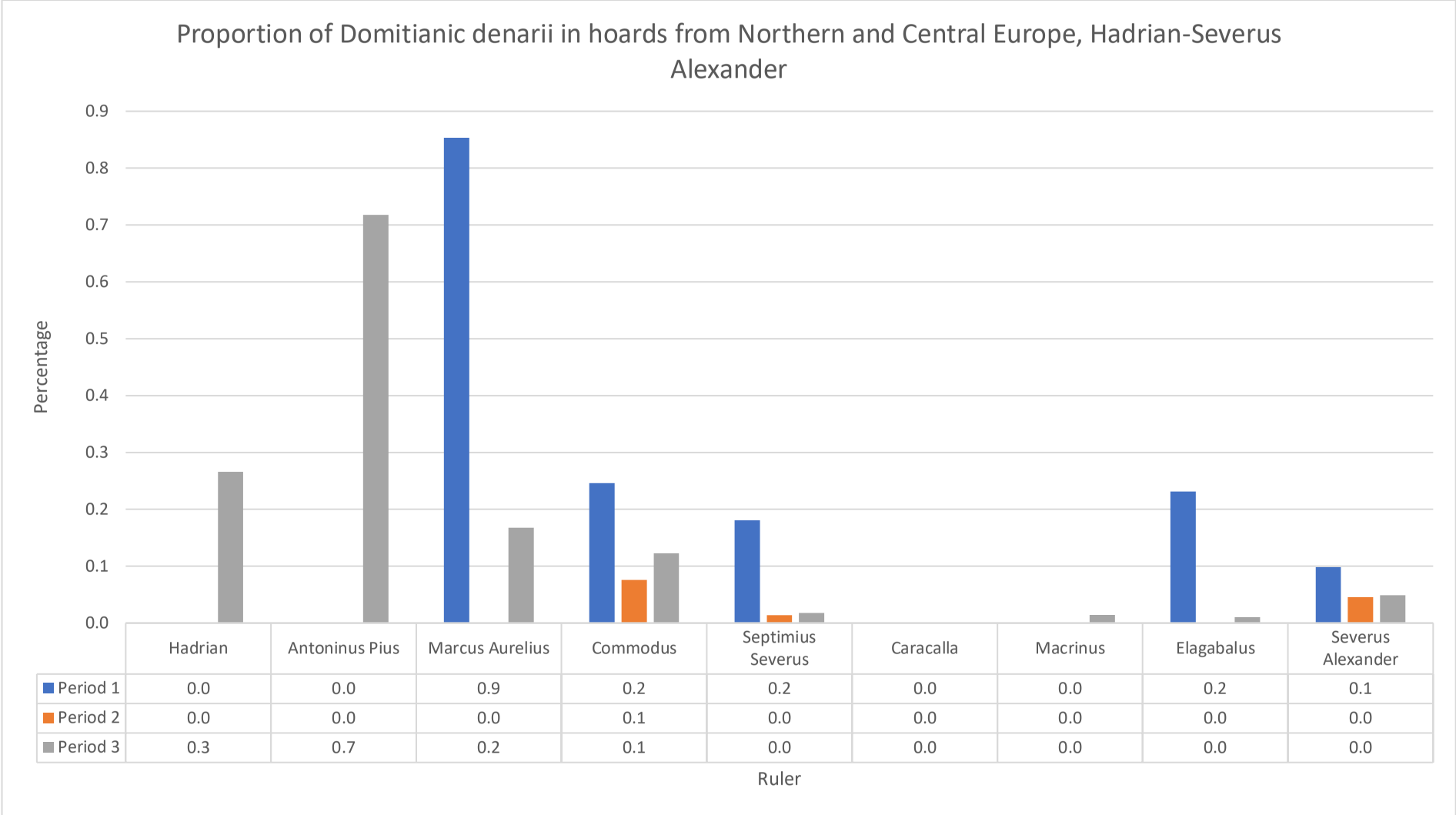
Hoards from outside the Empire

Ruler	Number of hoards	Number of coins	Period 1				Period 2				Period 3			
			Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)
Commodus	1	180	0	0	0	0	0	0	0	0	7	3.9	0.3	0.2
Septimius Severus	4	774	3	0.4	3	0.4	0	0	0	0	11	1.4	0.5	0.1
Severus Alexander	1	1914	13	0.7	13	0.7	0	0	0	0	26	1.4	1.2	0.1

Table 7: summary of Domitianic denarii in coin hoards found in Scotland, Commodus to Severus Alexander. Due to the very limited sample size, graphs have not been produced for this data.

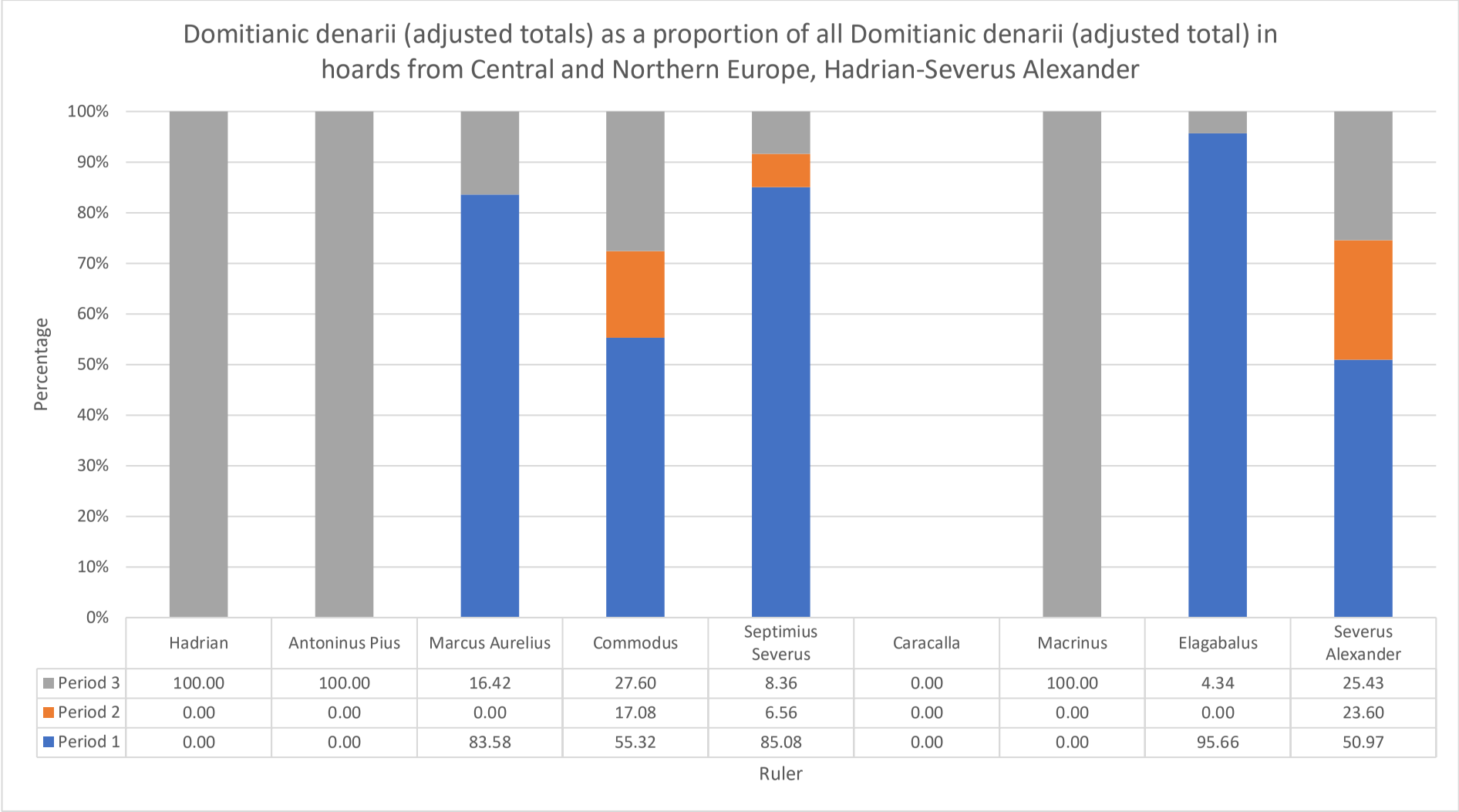
Ruler	Number of hoards	Number of coins	Period 1				Period 2				Period 3			
			Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)
Hadrian	1	18	0	0	0	0	0	0	0	0	1	5.6	0	0.3
Antoninus Pius	1	80	0	0	0	0	0	0	0	0	11	13.8	0.5	0.7
Marcus Aurelius	6	728	6	0.8	6	0.9	0	0	0	0	26	3.6	1.2	0.2
Commodus	14	1251	3	0.2	3	0.2	1	0.1	0.9	0.1	33	2.6	1.5	0.1
Septimius Severus	23	6659	12	0.2	12	0.2	1	0	0.9	0	26	0.4	1.2	0.1
Caracalla	2	61	0	0	0	0	0	0	0	0	0	0	0	0
Macrinus	1	1263	0	0	0	0	0	0	0	0	4	0.3	0.2	0
Elagabalus	1	867	2	0.2	2	0.2	0	0	0	0	2	0.2	0.1	0
Severus Alexander	4	2054	2	0.1	2	0.1	1	0	0.9	0	22	1.1	1	0

Table 8: summary of Domitianic denarii in coin hoards found in Northern and Central Europe, Hadrian to Severus Alexander.



	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Caracalla	Macrinus	Elagabalus	Severus Alexander
Period 1	0.0	0.0	0.9	0.2	0.2	0.0	0.0	0.2	0.1
Period 2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Period 3	0.3	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0

Figure 12: bar chart displaying the data in Table 7. All figures are adjusted percentage proportions.

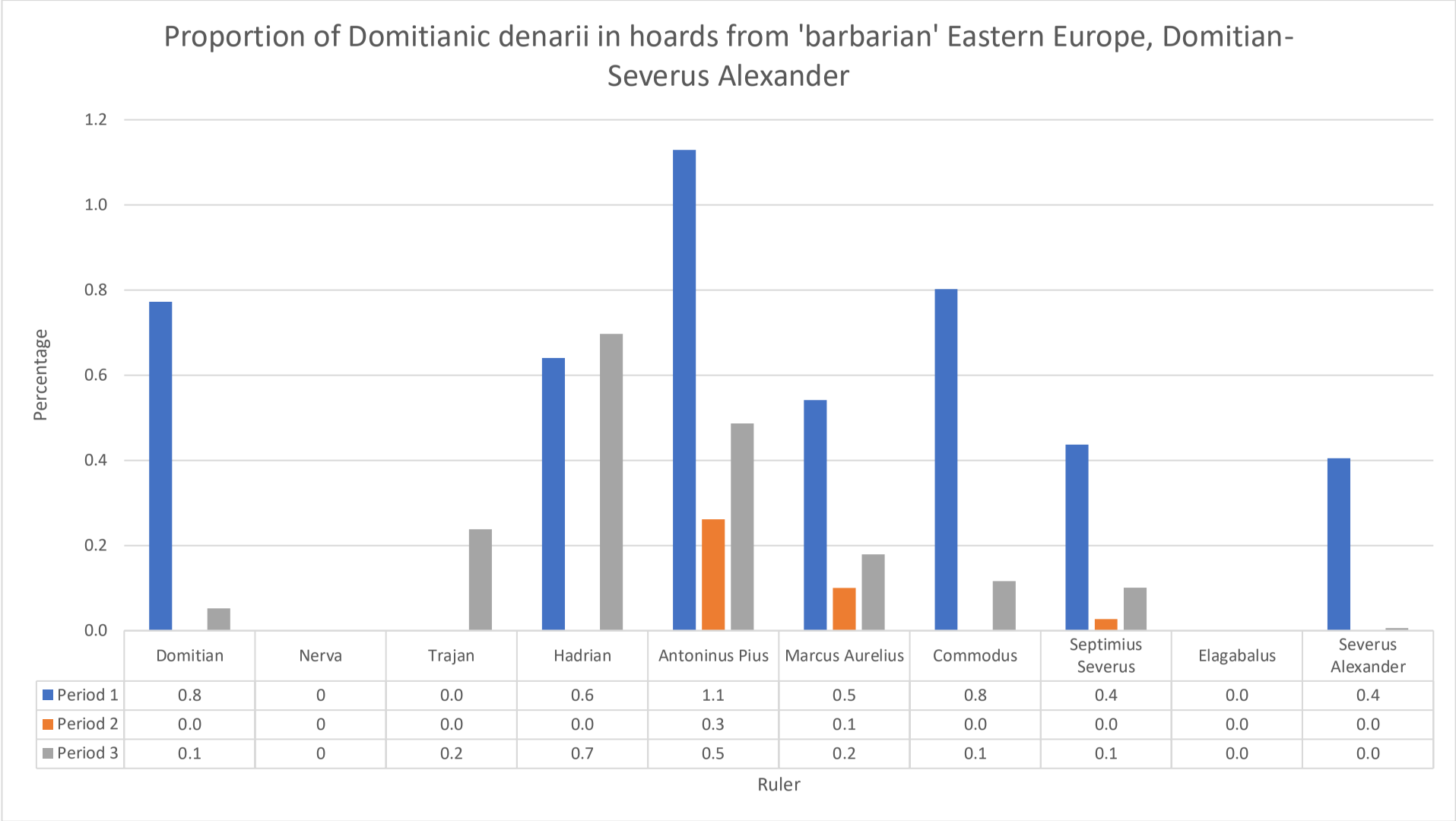


	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Caracalla	Macrinus	Elagabalus	Severus Alexander
Period 3	100.00	100.00	16.42	27.60	8.36	0.00	100.00	4.34	25.43
Period 2	0.00	0.00	0.00	17.08	6.56	0.00	0.00	0.00	23.60
Period 1	0.00	0.00	83.58	55.32	85.08	0.00	0.00	95.66	50.97

Figure 13: 100% stacked bar chart showing adjusted totals of Domitianic denarii of each period as a proportion of all Domitianic denarii (adjusted total) in hoards from Central and Northern Europe, Hadrian to Severus Alexander. All figures in percentages.

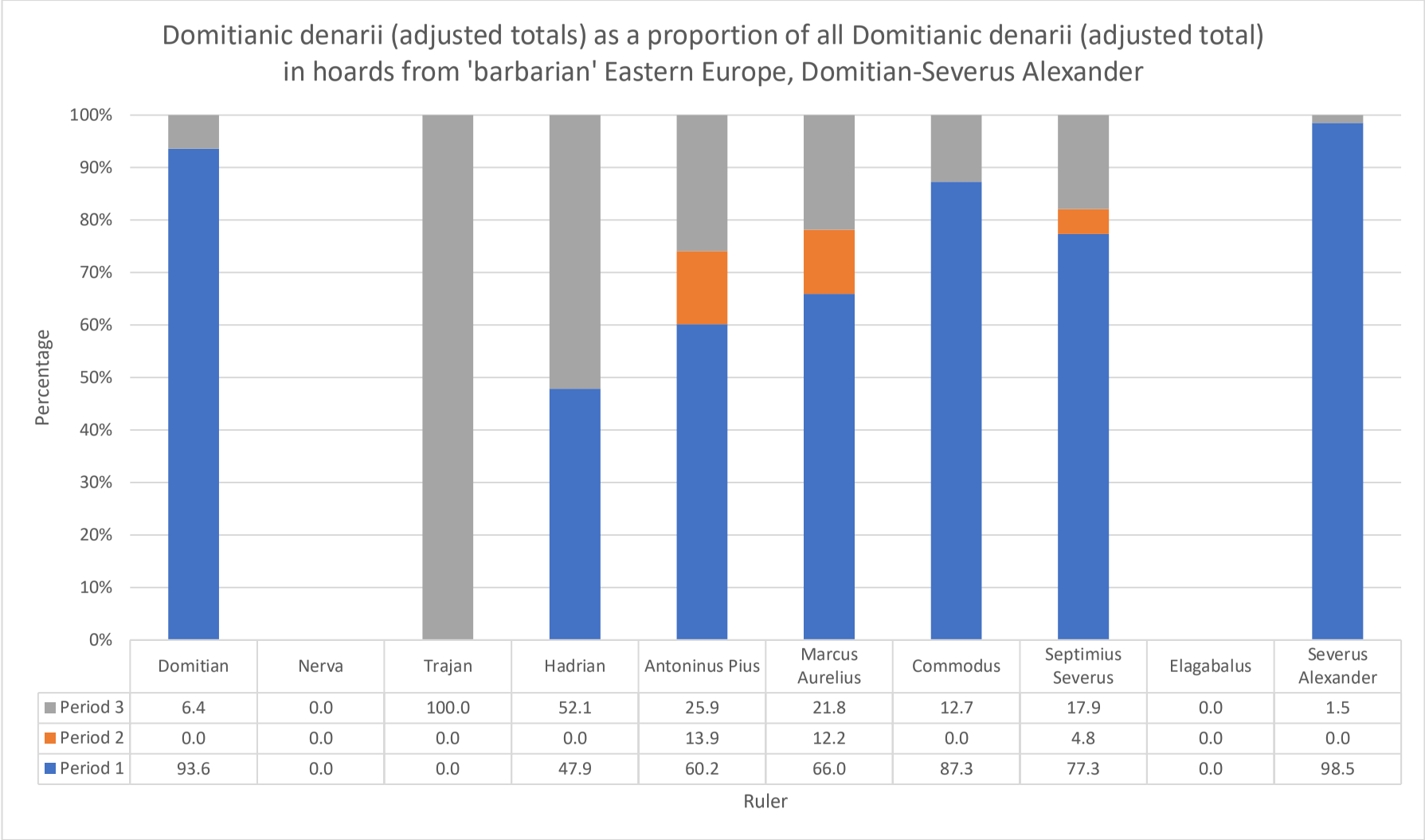
Ruler	Number of hoards	Number of coins	Period 1				Period 2				Period 3			
			Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)	Total	Proportion (%)	Adjusted total	Adjusted proportion (%)
Domitian	2	785	6	0.8	6	0.8	0	0	0	0	9	1.1	0.4	0.1
Nerva	1	37	0	0	0	0	0	0	0	0	0	0	0	0
Trajan	1	40	0	0	0	0	0	0	0	0	2	5	0.1	0.2
Hadrian	4	179	1	0.6	1	0.6	0	0	0	0	24	13.4	1.1	0.7
Antoninus Pius	3	781	8	1	8	1.1	2	0.3	1.9	0.3	76	9.7	3.4	0.5
Marcus Aurelius	5	1916	10	0.5	10	0.5	2	0.1	1.9	0.1	73	3.8	3.3	0.2
Commodus	6	1915	15	0.8	15	0.8	0	0	0	0	48	2.5	2.2	0.1
Septimius Severus	13	7008	30	0.4	30	0.4	2	0	1.9	0	153	2.2	6.9	0.1
Elagabalus	1	47	0	0	0	0	0	0	0	0	0	0	0	0
Severus Alexander	1	742	3	0.4	3	0.4	0	0	0	0	1	0.1	0	0

Table 9: summary of Domitianic denarii in coin hoards found in 'barbarian' Eastern Europe, Domitian to Severus Alexander.



	Domitian	Nerva	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Elagabalus	Severus Alexander
Period 1	0.8	0	0.0	0.6	1.1	0.5	0.8	0.4	0.0	0.4
Period 2	0.0	0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0
Period 3	0.1	0	0.2	0.7	0.5	0.2	0.1	0.1	0.0	0.0

Figure 14: bar chart displaying the data in Table 8. All figures are adjusted percentage proportions



	Domitian	Nerva	Trajan	Hadrian	Antoninus Pius	Marcus Aurelius	Commodus	Septimius Severus	Elagabalus	Severus Alexander
Period 3	6.4	0.0	100.0	52.1	25.9	21.8	12.7	17.9	0.0	1.5
Period 2	0.0	0.0	0.0	0.0	13.9	12.2	0.0	4.8	0.0	0.0
Period 1	93.6	0.0	0.0	47.9	60.2	66.0	87.3	77.3	0.0	98.5

Figure 15: 100% stacked bar chart showing adjusted totals of Domitianic denarii of each period as a proportion of all Domitianic denarii (adjusted total) in hoards from 'barbarian' Eastern Europe, Domitian to Severus Alexander. All figures in percentages.

Several hoards with *a terminus post quem* during the period under consideration can be found beyond the borders of the Roman Empire. The majority of these come from the area beyond the Rhine and Danube frontiers, in regions of modern Germany, Romania, Scotland, Poland and Sweden. There are very few hoards of Roman silver beyond the eastern or southern borders, with the exception of India. However, the hoards here are clear examples of preferential export of coins, as they are overwhelmingly composed of two particular issues of Augustus and Tiberius and are therefore largely useless for a study of Domitianic coin. Indian hoard evidence does demonstrate that the presence or absence of certain denarius issues in these hoards may indicate preferential export to external regions. In accordance with the internal logic of Gresham's Law, we would expect any export to be of finer silver issues as their bullion value would be easier to realise in regions with lower levels of monetisation and a larger reliance on a barter economy.

The few denarius hoards recorded in detail which have been found in Scotland are all of a very late date when compared to their southern neighbours. In the current sample of six hoards, one dates to the reign of Commodus, four to Septimius Severus and the final one to the reign of Severus Alexander. In the Rumbling Bridge hoard of 180 denarii, ending in AD 186/187, seven coins were issued during Domitianic period 3 with no examples of either of the other two periods. By this time the finest silver period 2 denarii were very scarce across the Empire, so the presence of the next-finest period 3 issues may indicate that the owner of the Rumbling Bridge hoard made efforts to acquire and secrete the best quality coins which were available to them. Alternatively, it could be that the owner of the hoard was in dire need of silver and that the denarii present in the hoard represent any issues which they could lay their hands on. As period 3 Domitianic denarii appear to have still been the most numerous in discrete terms at this time (as indicated from the hoard evidence from Roman Britain), it could be the case that they were the only ones available for hoarding at the time. Without further contemporary hoard evidence it is difficult to say.

The 774 denarii in the four Scottish hoards of Septimius Severus contain a total of 3 denarii of period 1 and 11 of period 3, making up 0.4% and 0.1% respectively of silver coins in hoards after adjustment. The proportion of period 1 issues is slightly higher than the contemporary proportion in hoards in the Roman areas of the Isles, while that of period 3 is the same. The presence of period 1 denarii in two of these hoards shows that they did reach as far north as Scotland, and perhaps even survived in greater numbers to the north of Hadrian's Wall than they did to the south? This is supported by the evidence of the large Falkirk hoard of 1,917 denarii, ending with an issue of AD 230 under Severus Alexander.

This hoard contains 13 examples of period 1 issues, comprising 0.7% of the hoard after adjustment, and 26 denarii of period 3 making up a total of 0.1% of the hoard. The thirteen period 1 denarii in the Falkirk hoard are more than all period 1 denarii discovered in hoards of Severus Alexander from south of the Wall (12 out of a total of 13,451 denarii), which perhaps indicates that period 1 issues moved north to the Scottish frontier in the Severan period. This is supported by the fact that the similar quality issues of AD 64-81 and even more fine period 3 Domitianic denarii are also much more abundant at Falkirk than in hoards from further south.[194]Without evidence of comparable date to the Falkirk hoard it is impossible to determine how typical its contents are, but it does indicate a potential movement of finer silver to the frontier regions of Britain.

Hoard evidence from northern and central Europe is much more abundant than that from Scotland, as would be expected. Some obstacles are presented by the lack of a tradition of accurate recording of hoards in some countries, particularly those which were not part of the Roman Empire at all.[195] The current sample contains no hoards from the reigns of Domitian, Nerva or Trajan, and one very small Polish hoard of 18 denarii containing a single denarius of period 3. The slightly larger Middels-Osterloog hoard, containing 80 denarii to the reign of Antoninus Pius, contains 11 examples of the denarii of period 3. These small hoards indicate that the denarii of Domitian had spread to the north of Europe by the mid-second century AD, but the lack of any denarii of the finest period 2 issues would suggest that little to no export of fine silver coin took place across the frontier at this time.

The northern European hoard evidence for the reign of Marcus Aurelius is considerably more abundant, with 728 denarii in 6 hoards. Of these coins, six are denarii of period 1 while twenty-six are denarii of period 3. After adjustment, period 1 issues make up 0.9% of all denarii in hoards while those of period 3 make up 0.2%. This would appear to suggest potential preferential hoarding of the least fine Domitianic silver, however the even more substantial hoard data for the subsequent reign of Commodus seems to indicate the opposite. Of the 1,251 denarii in 14 hoards, three (0.2% after adjustment) are of period 1, one (0.1%) is of period 2 and thirty-three (0.1%) are of period 3. The seeming equality between these groups of denarii would indicate little preference for any specific coins amongst hoarders in Northern Europe, let alone any kind of preferential hoarding of finer

[194] 26 period 3 denarii compared to a total of 11 in hoards of Severus Alexander in Roman Britain, and 520 denarii of AD 64-81 compared to a total of 762 south of the Wall (712 of which are from the Shapwick hoard alone).
[195] With the notable exception of Sweden, thanks to the excellent catalogue of hoards compiled by Lennart Lind; Lind (1981).

silver coin. This is borne out by the fact that Republican and pre-AD 64 Julio-Claudian coin, of similar weight and fineness to the denarii of Domitian's period 2, are very rarely found in this region.

Proportionally, the denarii of periods 2 and 3 decline to less than 0.1% under Septimius Severus while those of period 1 stay the same at 0.2%. This may reflect the decline in the numbers of these finer silver issues which can be seen in hoards from within the Roman Empire, and the subsequent fall in the movement of these types across the frontier. Again, no preferential export of Domitianic issues of any kind can be discerned from the evidence. The denarii of period 1 then disappear entirely in the single Polish hoard of 1,263 denarii from the sole reign of Caracalla (4 period 3 denarii are recorded), before returning again in the smaller hoard samples under Elagabalus (two denarii out of 867) and Severus Alexander (2 denarii out of 2,054). However, by this time it is evident that the supply of Domitianic coin to the regions beyond the Rhine frontier had long since dried up and the circulation of these coins had, for all intents and purposes, ceased.

Across the Danubian frontier, in areas of modern Romania and Hungary, many more denarius hoards can be found. The recording of coin hoards in this area has traditionally been very good, providing a large corpus of material for examination. Two hoards ending during the reign of Domitian himself, from Poiana and Gradistea, contain 0.8% period 1 denarii and 0.1% period 3 denarii indicating that these coins moved east reasonably rapidly following their production. The Dobarca hoard of 37 denarii, ending with coin of Nerva, contains no Domitianic issues while the 40 denarii of the Cocoseti hoard includes two coins of period 3. However, the small size of these hoards makes drawing any conclusions extremely problematic. The 179 denarii in the Hadrianic sample includes one denarius of period 1 and 24 examples of period 3 coin, making up 0.6% and 0.7% of the sample after adjustment respectively. The lack of the finest Domitianic silver issues is again noticeable and may indicate that they did not reach the area in large numbers, if at all. In any case there is no evidence to suggest the preferential hoarding of one group of Domitianic denarii over the others at any point during the first half century of their circulation lives.

Period 2 denarii then make an appearance in hoards of Antoninus Pius, with two examples out of 781 recorded denarii for an adjusted proportional total of 0.3%. There are also 8 coins of period 1 (1.1%) and 76 of period 2 (0.5%). It is possible that some link between the hoarding of period 2 denarii and the coinage reforms of Antoninus Pius could be made, but it seems more likely that this change in fact represents the increased accuracy of a larger

sample size. Again, by this time the denarii of period 1 are becoming more common than those of the other 2 periods in hoards when adjusted for issue size, perhaps indicating the slow but steady removal of finer silver Domitianic coin from circulation. However, the difference is so slight and the numbers involved so few that it would be difficult to confirm or deny with the currently available evidence.

This trend continues under Marcus Aurelius, with adjusted proportional totals of 0.5%, 0.1% and 0.2% for each of the three successive groups of Domitianic silver. The difference then becomes even more stark under Commodus, with denarii of period 2 entirely disappearing from hoards, the number of period 1 denarii increasing from 10 to 15 (to 0.8% of the total) and the number of period 3 denarii falling from 73 to 48 (down to 0.1%). The contents of these two groups of hoards would definitely seem to suggest a decrease in the availability of period 3 denarii for hoarding, probably linked to an overall decline in the number of these coins in the circulation pool as a whole. This drop can be seen within the Empire itself and may be linked to the reforms of the coinage undertaken towards the end of the second century. Examination of the large sample available for the reign of Septimius Severus would continue to bear this out, with the proportion of period 1 denarii again outstripping that of period 3 denarii at 0.4% to 0.1%. The denarii of period 2 are still found in hoards of this period, in contrast with finds from Britain and Western Europe, and may reflect the continued circulation of finer silver issues in Roman Eastern Europe long after they had left in the West. The small Blagesti hoard ending under Elagabalus contains no Domitianic silver, while the much larger Muntanesti hoard of Severus Alexander again contains more denarii of period 1 than period 3 (0.4% to less than 0.1%).

Broadly then the hoards beyond the frontier show a similar pattern to those within the bounds of the empire, with all three groups being hoarded in similar numbers before the denarii of period 2 leave circulation around the time of Hadrian. The proportion of period 1 issues then outstrips that of period 3, indicating that the second finest group of Domitianic coin was removed from circulation at a faster rate than the least fine issues. There is no evidence for any preferential export of Domitianic coins, fine or otherwise, from any region at any time, seemingly removing this scenario from contention when discussing the actions of coin users in response to coinage reforms or debasements.

Summary: Domitian

The two successive reforms to the denarius carried out under Domitian were the only major changes to the fabric of the coinage carried out between the reforms of Nero in AD

64-68 and those of Septimius Severus in AD 194 and had a significant effect on the circulation life of his coins for decades. Hoard evidence examined here indicates that the three groups of denarii all seem to have experienced broadly similar effects across the empire, with the finest issues of period 2 declining rapidly around the mid-second century alongside the similarly heavy and pure Republican and Julio-Claudian coin still in circulation. This fits well with the argument advanced by Butcher and Ponting that, following his failed attempt to return to the pure denarius minted during the Republic and Julio-Claudian periods, Domitian initiated a recall of finer silver in order to stabilise the monetary economy. As the issues of the Republic formed the bulk of coin in circulation at the end of the first century AD this recall could not be completed by Domitian alone, so it was continued under his successors Nerva and Trajan,[196] ending at some point during the reign of Hadrian.

Up to this point there seems to have been little discrimination between denarii of period 1 and period 3 in selection for hoards, despite their differing silver contents. This perhaps suggest that either the public were not aware, or were not overly concerned by, the variance in the intrinsic value of these coins. The author would incline towards the former, due to the similar appearance of period 1 and period 3 denarii and lack of any outward indications of their differing composition. If the reforms of AD 82 did indeed include an in increase in weight, thereby betraying the increased value of freshly minted period 2 denarii, it would further strengthen this viewpoint.

However, following the disappearance of period 2 denarii from hoards at some point during the reigns of Hadrian and Antoninus Pius, the issues of period 3 seem to undergo a decline in their proportional representation in hoards. This could be partially ascribed to the natural wastage and attrition which circulating coin populations undergo over time. However, the denarii of period 1 do not experience a similarly rapid decline, and instead seem to experience a slight revival of their numbers in hoards towards the end of the second century and into the beginning of the third century AD. This would suggest two things. Firstly, that the denarii of period 3 are leaving the circulation pool more rapidly than the denarii of period 1. This is reinforced when it is noted that in several areas the total number of period 3 denarii in hoards of Severus Alexander is similar to or, in the case of

[196] Interestingly, Trajan returned the denarius to the First Neronian standard of 80% in around AD 100, suggesting that this may have been the preferred standard all along but that it could only have been introduced once the Republican and Julio-Claudian denarius population had declined sufficiently to allow it to circulate effectively.

British hoards, lower than the denarii of period 1. Secondly there seems to have been an increase in the desire to hoard Domitianic denarii, particularly those of period 1, from the time of Marcus Aurelius onwards. This may have been triggered by the reforms undertaken during the reigns of Antoninus Pius and Septimius Severus, which lowered the silver content of newly minted denarii substantially. The decrease in the weight of new silver, which may have taken place under Commodus, would have perhaps alerted coin users to the change in the fabric of new denarii and increased the desire to hoard earlier issues (if any such change did indeed take place). This accelerated rate of hoarding, coupled with attrition, means that the denarii of Domitian appear to have all but left circulation within the Roman empire by the reign of Severus Alexander.

This case study suggests that changes to the weight of the denarius may have been easier to detect that modifications to the alloy used. When alerted to the possibility that the intrinsic value of new coins had decreased, hoarders may have attempted to accumulate older issues. There is little evidence to suggest the large-scale export of finer Domitianic denarii beyond the boundaries of the empire at any point, although there is slight evidence of movement of fine coin towards the frontiers in hoards from latter second century AD Britain, Roman Western and Eastern Europe and Scotland. Coin users instead appear to have hoarded better quality coins where possible, although the magnitude of this effect is uneven across the empire. The state also appears to have had some interest in the intrinsic value of coin issues, and the abrupt removal of fine silver coin (including the period 2 denarius issues of Domitian) in the early second century suggests that they may have withdrawn certain issues either to make a profit or, more likely, to rectify problems with the monetary economy.

The Crisis of the Third Century Part 1: the Denarius

The monetary reforms of Septimius Severus saw the first major changes to the composition of the denarius since those of Nero and Domitian over a century prior.[197] His son Caracalla was the first to introduce a new denomination, the antoninianus or radiate, to the Roman currency system for over 200 years. The scale of these changes, and the fact that they occurred just before the so-called 'Crisis of the Third Century,' means that the monetary history of the Severan period is one of the most scrutinised in modern scholarship.

This chapter seeks to contribute to that debate by providing an up to date analysis of coin hoards from across the Roman empire. It will largely follow the structure of the previous case study: a discussion of the historiography of the Severan reforms, setting the chapter in its scholarly context and laying out the major debates and disagreements in studies of the period; an outline of research questions which the case study aims to answer; a summary of the methodology to be used; the main analysis of coin hoards (set out in chronological order to create a narrative of the effects of the Severan reforms); and finally a summary of the key findings of the whole chapter.

Historiography

Recognition of the early third century as a point of change in the Roman silver coinage extends as far back as the 17th and 18th centuries. Early studies, most notably the metrological survey of Rome de l'Isle[198] and the metallurgical analyses of scholars such as Savot[199] and Patin,[200] suggested that several debasements of the silver coinage took place at some time under the Severan emperors Silver coins featuring a bust of the emperor wearing a radiate crown (as opposed to the usual laurel wreath) and weighing one and a half times as much as a denarius were also increasingly recognised as a denomination separate from the denarius.[201]

---

[197] A series of minor changes to the metrology and metallurgy took place over the course of the second century, but these were small in scale and generally short-lived (with the exception of the Trajanic restoration of the First Neronian standard denarius mentioned in note 179 above.) For further details, see Butcher and Ponting (2012) *passim*.

[198] Romé de l'Isle (1789) 122-123; Rome de l'Isle dates reforms to Tiberius, Nero and Caracalla, with some fluctuations under Galba and Domitian.

[199] Savot (1627) 322; Savot dates the major debasement of the denarius to the reign of Severus Alexander.

[200] Patin (1667) 87 and 92-3; Patin states that debasement began during the Severan period until the reign of Gordian III.

[201] For example in works such as Eckhel (1792) xxvi-xxvii and Pinkerton (1808) 141-142; prior to this, the antoninianus had usually been considered to be a heavier denarius, see for example Greaves (1647) 114; the name of the denomination in antiquity is unknown, with 'antoninianus' (referencing

More empirical studies of the composition of the silver coinage came during the 19th century, when the decline in standards was fixed during the reign of Septimius Severus in works such as those by Akerman[202] and von Rauch.[203] Mommsen's *Geschichte des römischen Münzwesens*, translated into French as *Histoire de la Monnaie Romaine*, brought together these previous analyses and summarised them.[204] As mentioned above, Mommsen's work also attempted to account for the causes and effects of the changes that he saw. Notably, Mommsen was one of the first scholars to suggest that the reforms of Nero and Septimius Severus led to selective hoarding of pre- or post-reform coins.[205]

Following the synoptic work of Hammer,[206] very little significant metrological and metallurgical analysis of the Severan reforms was carried out during the following 65 years. The focus of scholarly output shifted towards studies of coin circulation and price data, with important studies such as those by Rostovtzeff,[207] Frank,[208] West[209] and later Bolin[210] and Crawford.[211] These works tended to stress the inherently destabilising effects of the Severan reforms on the monetary system, viewing them as major steps on a path of decline which began with Nero and ended with the financial collapse of the Roman currency in the AD 260's and 270's.[212] The influence of early twentieth century inflationary crises in Germany and elsewhere is felt throughout scholarship in this period, with the Severan reforms seen as an important contributor in a series of policies which led to rampant price increases in the latter half of the third century.[213]

As more advanced analytical techniques became available during the later twentieth century, new analyses of Roman coins were carried out and the level of detailed technical knowledge of the Severan reforms gradually improved. Julien Guey carried out several

---

the birth name of the emperor commonly known as Caracalla) suggested in Mommsen (1873) 70-71 and 'radiate' being a popular modern alternative referencing the radiate crown worn by the emperor's bust on the obverse. The former term will be used throughout this thesis.

[202] Akerman (1834) xiv-xix.

[203] von Rauch (1857) *passim*; summary tables 295-308.

[204] Mommsen (1873) 27-30.

[205] Mommsen (1873) 50-51 and 56.

[206] Hammer (1908) *passim*.

[207] Rostovtzeff (1957) 400 ff., esp. 413-414 (original edition published in 1926)

[208] Frank (1927) 487-490.

[209] West (1941)

[210] Bolin (1958) chapter XI; especially the comment on p.249 'The reduction in the fineness of the denarius by Septimius Severus meant that the Roman monetary system had taken the greatest and most important step up to that time on the road to chaos.'

[211] Crawford (1975) 560-593.

[212] A common perspective on the Severan reforms, see *infra* 112-115.

[213] See for example Mattingly (1928), where the 'inflation' of the third century AD is explicitly compared to the contemporary hyperinflation in Weimar Germany.

particularly important studies of Severan denarii in the 1960's. In the first of these papers, he suggests a decline in the silver content of the denarius from around 70% in AD 193 to 55% in the early months of AD 194 (an issue he describes as a 'transitory denarius'), with a second debasement to around 47.5% silver towards the end of that year. Guey also recognises that denarii issued by Clodius Albinus as Augustus in AD 196 were produced on a higher standard of around 75% silver.[214] In a subsequent paper building on the work of Condamin and Picon,[215] Guey made several corrections to the former study. Most notably, he drops his suggestion of the introduction of a 'transitory denarius' in AD 194 and instead indicates that a standard of around 47.5% was used across the empire from the Severan debasement onwards.[216]

Walker's *Metrology of the Roman Silver Coinage* suggested debasement in the denarius from around 70% to approximately 56% in AD 194, figures obtained using the XRF method which had been questioned by Condamin, Picon, Guey and others. In his commentary, Walker followed the viewpoint of Mommsen and his successors and continued to argue that debasement was inherently inflationary. As such Walker's position is that the reforms of Severus and his successors were detrimental to the strength of the Roman economy and monetary system.

Using the analysis method described in the opening chapter, Kevin Butcher and Matthew Ponting (alongside collaborators Graham Chandler and Haim Gitler) have carried out several analyses of Severan denarii.[217] These works have determined that the target fineness of the Severan silver coinage post-AD 194 was approximately 46%,[218] broadly agreeing with the figures provided by Condamin, Picon and Guey. Alongside this debasement of the alloy, Duncan-Jones suggests a restoration of the weight of the denarius to the Neronian standard of around 3.4g after a reduction under Commodus to around 2.8g.[219] The change appears to have been implemented uniformly across the empire,[220]

---

[214] Guey (1962) *passim* (summary tables p.106-107.)
[215] Condamin and Picon (1964), discussed further above p. 13-14.
[216] Guey (1965) 113, 115-116 *et passim*.
[217] Butcher *et al.* (1997); Gitler and Ponting (2003); a new study of the Severan reforms by Butcher and Ponting is currently under way, and data from the project has kindly been supplied by the authors.
[218] Butcher *et al.* (1997) 26-27; Gitler and Ponting (2003) 52.
[219] Duncan-Jones (1994) 222, summarised 225; the difficulty of determining the target weights of ancient coinage has been discussed above, see *supra* 18-19.
[220] Gitler and Ponting (2003) 52.

with the exception of the coinage of Clodius Albinus as Augustus, minted in Gaul c. AD 195-197, which were produced at the Neronian standard of 80%.[221]

The monetary and economic effects of the Severan reforms have also been recently reanalysed. In a particularly important work on the subject, Dominic Rathbone has argued that the available evidence (mostly from Egypt) suggests that that no real increase in prices took place between the reign of Marcus Aurelius and the reforms of Aurelian in c.AD 274/275.[222] In this he goes against the line of argument established by Mommsen and carried on by Walker and others. Rathbone suggests that the increase in prices under Marcus Aurelius may have been due to the impact of the Antonine Plague, while that under Aurelian may have been linked to a retariffing of the Egyptian tetradrachm against the aureus.[223] In neither case does 'inflation' appear to have been linked to debasement and a corresponding increase in the money supply, with Rathbone arguing that an increase in monetisation over the course of the third century absorbed the enlarged pool of currency in circulation and thus prevented inflation.[224] Of course, the available evidence is limited both in quantity and in geographic scope, and as such all conclusions drawn from it must be taken with a pinch of salt. However, Rathbone's synopsis of the price data does seem to indicate that inflation, at least in Roman Egypt, did not occur on a major scale until the end of the third century, well after the major period of coinage debasement.

This tallies with the evidence for the state of the wider Roman economy during Severus' reign. There was a major boom in civic works and urban construction, particularly in the provinces of Northern Africa which had close links to the Severan dynasty. Several other provinces, such as Sicily, received investment from the imperial coffers. Interest rates reduced, the scale of trade increased and there was a boom in production. [225]

The impact of the Severan reforms on hoarding patterns, the topic of this work, has also been debated in a series of case-studies carried out by Christopher Howgego, Richard Duncan-Jones and Benjamin Hellings. In his original 1994 work, Howgego contended that the hoard evidence from Britain during the period AD 193-263 demonstrated a rise in the number of early 'Old Style' Eastern denarii of Septimius Severus, minted AD 193-196/7, as a

[221] Butcher *et al.* (1997) 26-27 *et passim*.
[222] Rathbone (1996) 329-333.
[223] Rathbone (1996) 334-335.
[224] Rathbone (1996) 337-338.
[225] Wassink (1991) 479; Corbier (2015) 329; Pfuntner (2016) *passim*.

proportion of all denarii minted between those years.[226] Howgego argued that this was demonstrative of an influx of these coins into the British Isles, evidencing the steady movement of coins around the empire through means such as redistribution of tax and trade. Duncan-Jones refuted this conclusion in his 2001 reply, proposing instead that the increase in the number of Old Style Eastern denarii occurs alongside a similar rise in contemporary denarii struck at Rome as a proportion of all denarii of Septimius Severus in hoards.[227] Duncan-Jones suggested that this is due to the preferential removal of the later Eastern and Western issues, which may have been struck on a superior weight standard to the denarii issued during Severus' struggle for the throne in the early part of his reign. An exchange of articles in the following edition of the *Numismatic Chronicle* saw Howgego restate his position and argued that Duncan-Jones comparison between the early Eastern and Roman issues and their later counterparts misunderstood his point,[228] while Duncan-Jones pointed out that including the lighter IMP IX and IMP X issues of Rome in the analysis eliminated the proportional increase in Eastern issues.[229]

Benjamin Hellings contributed to the debate in 2016 with an article extending the study to the hoards of Roman Germany, using broadly the same methodological approach as Howgego's original work.[230] Hellings' findings show similar influxes of Old-Style eastern denarii into hoards in two phases, one around AD 235 and the other circa AD 248-253. Hellings suggests that these are reflective of the reinforcement of the German *limes* with troops from the East during periods of Germanic aggression and rejects the hypotheses of Duncan-Jones on the basis that the potentially heavier Eastern denarii appear to have received no preferential treatment in circulation when compared with their Rome-issued counterparts.

The back and forth on this subject demonstrates the importance of detailed consideration of methodology; two series of studies reach differing conclusions from the same dataset, purely due to the inclusion or exclusion of particular groups of coin in the study. It also provides an illustration of the potential value of coin hoard studies, and the importance of the material evidence when considering wider questions such as the extent of economic homogeneity in the Roman world, the action by which coinage circulated (or not) and the

[226] Howgego (1994) 15. Howgego also notes a similar, if less convincing, pattern in the evidence for the reign of Gordian III.
[227] Duncan-Jones (2001) *passim*.
[228] Howgego (2002) *passim*.
[229] Duncan-Jones (2002) *passim*
[230] Hellings (2016) *passim*.

impact of Gresham's Law on monetary stock. One major question to which the coinage of Severus and his successors is most pertinent is the scale, scope and nature of the so-called 'Crisis of the Third Century,' a topic which we will now consider in more detail.

The 'Crisis of the Third Century'

The third century AD, particularly the period from assassination of Severus Alexander in AD 235 to the accession of Diocletian in AD 284, has historically been seen as the time of transition from 'Classical' and 'Late' antiquity. However, scholars are currently divided on the nature of that shift.

The prevailing theory during the twentieth century was that of a 'Third Century Crisis' or the 'Military Anarchy.' In this model the Roman empire was subject to several major catastrophes during the mid-third century, including large scale external and civil wars, constant political strife including imperial assassinations and usurpations, plagues including the devastating Plague of Cyprian, economic collapse and hyperinflation. This perspective is derived from two major sources. The first is the writings of ancient authors who, following a common *topos* in ancient histories, were keen to describe how the affairs of their own time represented a vast decline from the 'Golden Age' of the past.[231] The second is the works of 'Enlightenment' authors, most notably Edward Gibbon who established a narrative of the 'Decline and Fall of the Roman Empire' in his monumental work of the same name.[232]

The debasement of Septimius Severus is often seen as one of the major contributory factors in the descent towards a 'Third Century Crisis,' as well as a major symptom of it. The account commonly follows this pattern; Severus, having risen to power through the support of the military, maintained his position through his martial persona and through his lavish expenditure on the soldiers. This included expanding the size of the standing army from 30 to 33 legions and increasing military pay for the first time since the reign of Domitian.[233] This, in turn, increased the pressure on the state's financial resources, with expenditure now beginning to outstrip income. In addition, there is evidence to suggest that silver bullion production was declining at the end of the second century and the beginning of the third, depriving the mint of its supply of raw materials.[234] Dio mentions

[231] See Alföldy (1974) *passim* for a summary of ancient views on the 'Crisis of the Third Century.'
[232] Gibbon (1776) *passim*.
[233] For primary sources on the Severan pay increase, see Herodian, *Roman History* III.8.4 and *Historia Augusta* Sev.12.2; an increase of 50% is suggested as the most likely in Alston (1994) 114-115.
[234] Domergue (1990) 219-224; Jones (1980) *passim*.

that Severus was adept at raising new sources of revenue,[235] but this does not seem to have been enough. Severus was forced to debase the coinage to ensure that his silver supply could adequately cover the monetary needs of the state. As the century wore on and the soldiers demanded more and more money to support Severus and his successors, coins became increasingly debased until they contained only a token amount of silver. The introduction of the antoninianus by Caracalla was another measure intended to increase the monetary supply, creating a coin with twice the face value of the denarius but only 1.5 times the silver content. The combination of the debasements and the production of the radiate created chaos, most notably hyperinflation, the increasing preference for payment in kind and the rapid removal of fine silver coinage from circulation, which in turn led to the collapse of the whole monetary and economic system until the reforms of Diocletian at the end of the century.[236]

A competing viewpoint, one which has become more prominent since the early 1990's, holds that the third century AD was not a time of 'crisis' but instead one of 'transformation.' Adherents of this theory suggest that the shift from the 'Classical' to the 'Late' Roman empire was not the result of a sudden sequence of events occurring over a decade or two but was instead the product of long-term processes which took place over a century or longer. While generally not denying that individual crises (such as plagues or barbarian invasions) took place during the third century, 'transformationist' scholars believe it is inappropriate to characterise the whole period as one continuous crisis. 'Transformationists' also point to the paucity of data for hyperinflation and other forms of economic dislocation during the third century, as well as suggesting greater levels of continuity in social, political and economic life between the second, third and fourth centuries than previously thought.[237]

The debate over the 'crisis' and 'transformation' theories continues unabated. The main problem with assessing the nature of the changes which took place in the third century is the lack of data, particularly contemporary historical narratives and other literary sources. In their place the historian is forced to turn to the material evidence, of which coinage is a

---

[235] Cassius Dio, *Historiae Romanae* 75.8.4.

[236] It is impossible to give a full listing of scholars who wholly or partially subscribe to this or similar views, but for examples and discussion see Mattingly (1928) 185-186; Rostovtzeff (1957) 400ff. [esp. 414 and 423-424]; Crawford (1975) 560-593; Walker (1978) 130-132;Bursche (1991) 300-301; Lo Cascio (1996) 283-285; Gitler and Ponting (2003) 7; Elliott (2014) *passim* [esp. 140 and 150-151].

[237] Important works which stress 'transformation' during the third century AD include Strobel (1993); Cameron (1993) (especially chapter 1); Witschel (1999) (updated and summarised in Witschel (2004)); Potter (2004).

major component. The complex nature of the modifications to the coinage in the third century AD, as well as our limited understanding of the consequences of debasement in the Roman period, have hampered attempts to describe the monetary and economic situation in the third century. However, just as improvements in analytical techniques have improved our understanding of the physical nature of the Roman coinage during these years, this work hopes to aid in the assessment of the economic health of the Roman empire during this critical period.

As with the reforms of Domitian, the effects of the Severan monetary reforms remain poorly understood. However, given their importance in historical narratives of the period, it is crucial that modern scholarship attempts to approach a more complete comprehension of the impact of the reforms. In the literature review above several points of contention were identified, and it is the aim of this chapter to address them:

- Was the populace aware of the monetary reforms of the Severan period? And if so, how?
- Did the finer pre-reform silver coin still in circulation disappear from use from AD 194 onwards, per Gresham's Law? Why/why not?
- Could the general public distinguish between denarii struck by Severus on the pre-reform standard (AD 193-194) and those on the post-reform standard (AD 195-211) and, if so, what action did they take (if any)?
- Is there any identifiable difference in the circulation patterns of denarii struck on the pre-reform standard by Clodius Albinus as Augustus in AD 195-196?
- Can the rationale for the debasement of the denarius under Septimius Severus be deduced from the circulation patterns of the silver coinage?
- Did the monetary reaction to the reforms have any identifiable consequences in the third century AD, economic or otherwise?
- Was any reaction to the Severan reforms uniform across the empire? If not, why?
- Is it justifiable to categorise the monetary reforms of the early third century AD as a cause or an effect of a wider 'Crisis of the Third Century'?

The chronological scope of this survey will extend from the beginning of Septimius Severus' reign in AD 193 until the end of the reign of Aurelian in AD 275. As will be seen, by this point the vast majority of hoards contain no Severan denarii at all suggesting that they had almost completely ceased to circulate. As far as is practicable the entirety of the Roman

empire will be examined, divided into regions as with the Domitian case study in order to provide reasonably large hoard samples for analysis.[238]

The metallurgical and metrological data used to divide pre- and post-reform coins largely comes from the analysis of Gitler and Ponting,[239] with some supplementary data from other sources.[240] Broadly speaking, all coins of Septimius Severus up to and including the issues listed as RIC 39 are considered pre-reform, with subsequent coins listed as post-reform. For the coins of Julia Domna, those with obverses naming her as IVLIA DOMNA AVG are considered pre-reform while those using the IVLIA AVGVSTA legend are post-reform. The coins of Clodius Albinus as Caesar are included with pre-reform issues, while those issued under his own authority as Augustus are listed separately.[241] All coins of Caracalla, Geta and other imperial family members issued during the reign of Septimius Severus are considered post-reform issues. Denarii minted at eastern mints are divided by the same criteria as those issued by the mint at Rome, while silver coins produced on eastern standards will not be considered.[242] It is likely that a few coins have been listed in the wrong category, particularly eastern issues which tend to include fewer details of Severus' titles and are therefore harder to date accurately. As with all other mistakes in this work any fault lies with the author. However, it is believed that such mistakes will be few enough to allow acceptably accurate analysis of the material, as long as care is taken not to rely on the presence or absence of small numbers of coins in drawing conclusions.

An attempt will be made to adjust the proportions of pre- and post-reform denarii to reflect their differing issue periods, as was undertaken in the previous case study. Denarii were issued on the pre-reform standard from Severus' accession in April 193 to sometime in AD 194, while the post-reform standard was used from AD 194 to Severus' death in February 211. Given the difficulty of accurately dating coins it is hard to say when exactly the reform of AD 194 took place, so for the sake of expediency the date of 31st December will be used here. Using this dating, pre-reform coins were issued for approximately 21 months while post-reform denarii were produced for around 193 months. As such, the

---

[238] See *supra* 43-44.
[239] Gitler and Ponting (2003) 55-57.
[240] Condamin and Picon (1964); Butcher *et al.* (1997); weights [with caution] in Duncan-Jones (1994) 222; updated fineness data from Butcher and Ponting's ongoing analysis of Severan coin, kindly provided by Kevin Butcher (pers.comm).
[241] Albinus' denarii as Augustus, issued AD 195-195, appear to have been struck on the revised Neronian standard of 80% purity.
[242] The debasement of AD 194 seems to been implemented at Rome and the eastern mints at the same time; see Gitler and Ponting (2003).

issue period of post-reform denarii was 9.19 times as long as that of pre-reform issues. To date, no detailed study of the output of Severus' denarii has been carried out and it is beyond the scope of this thesis to do so. As such adjustments cannot be made for output as in the Domitianic case study. However, by dividing the number of post-reform denarii by 9.19 and then comparing the relative proportions of pre- and post-reform coin it is hoped that the effects of different issue periods can be partially negated and a closer examination of the intentions of hoarders can be made. However, the discrete numbers and unadjusted proportions of denarii will also be provided for comparison.

Ruler	Average silver content of denarius	Average weight of denarius (g)	Average weight of silver per denarius (g)	Average weight of aureus (g)
Marcus Aurelius (AD 161-180)	70%	3.4	2.38	7.6
Commodus (period 1, AD 180-186)	68%	3.15	2.1	7.25
Commodus (period 2, AD 186-192)	68%	3	2	7.25
Civil War (AD 193)	68%	3	2	7.25
Septimius Severus (pre-reform, AD 193-194)	68%	3.4	2.31	7.25
Septimius Severus (post-reform, AD 194-211)	46%	3.4	1.56	7.25
Clodius Albinus (as Augustus), AD 195-196	68%	3.4	2.31	7.25
Caracalla, pre-reform (AD 211-215)	46%	3.4	1.56	7.25
Caracalla, post-reform (AD 215-217)	46%	3.4	1.56	6.5
Elagabalus	46%	3	1.38	6.5
Severus Alexander	46%	3.1	1.43	6.5
Maximinus Thrax	46%	3.1	1.43	N/A
Gordian III	46%	3.4	1.56	N/A

Table 10: denarius and aureus standards, Marcus Aurelius - Gordian III. Standards for Marcus Aurelius to Severus Alexander following Duncan-Jones (1994) *and personal communications from Prof. Kevin Butcher. Standards for Maximinus I and Gordian III taken from* West (1941)*, although these are overdue for review.*

Analysis

Septimius Severus-Elagabalus (AD 193-222)

Region	Number of hoards	Number of coins	Pre-Severan denarii	Septimius Severus pre-reform	Septimius Severus post-reform	Caracalla denarii	Caracalla antoniniani	Post AD 217 denarii	Post AD 217 antoniniani
Britain	17	5,292	3,744 (70.7%)	58 (1.1%)	1,477 (27.9%)	9 (0.2%)	1 (0%)	3 (0.1%)	0 (0%)
Western Europe	15	8,147	7,950 (97.6%)	35 (0.4%)	169 (2.1%)	14 (0.2%)	1 (0%)	3 (0%)	2 (0%)
Eastern Europe	11	4,606	3,916 (85%)	72 (1.6%)	605 (13.1%)	9 (0.2%)	0 (0%)	4 (0.1%)	0 (0%)
The East and North Africa	8	3,566	3,002 (84.2%)	62 (1.7%)	460 (12.9%)	26 (0.7%)	0 (0%)	6 (0.2%)	0 (0%)
Total	50	21,611	18,612 (86.1%)	227 (1.1%)	2,711 (12.5%)	58 (0.3%)	2 (0%)	16 (0.1%)	2 (0%)

Table 11: a summary of hoard evidence from Septimius Severus to Elagabalus, AD 193-222.

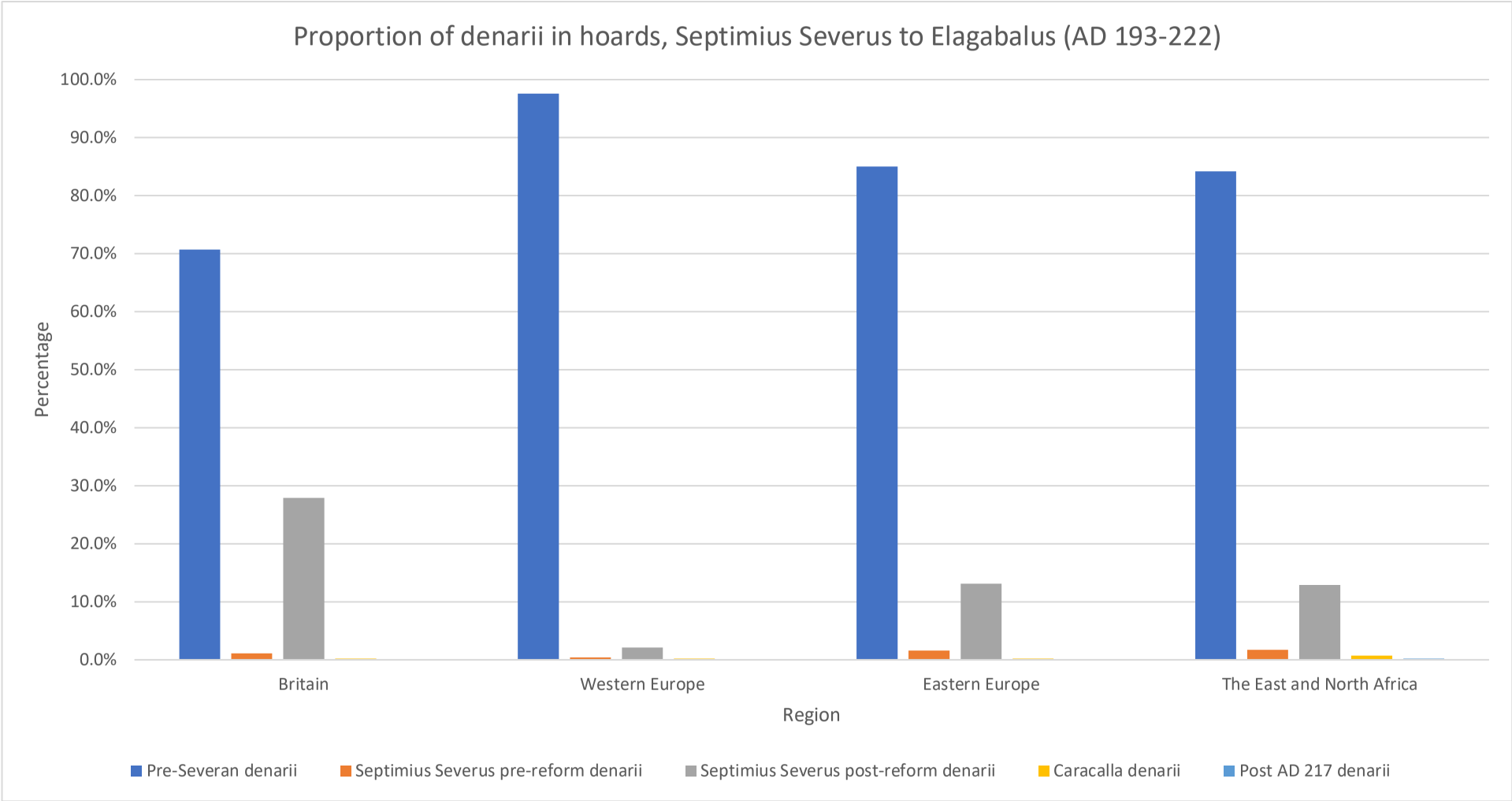
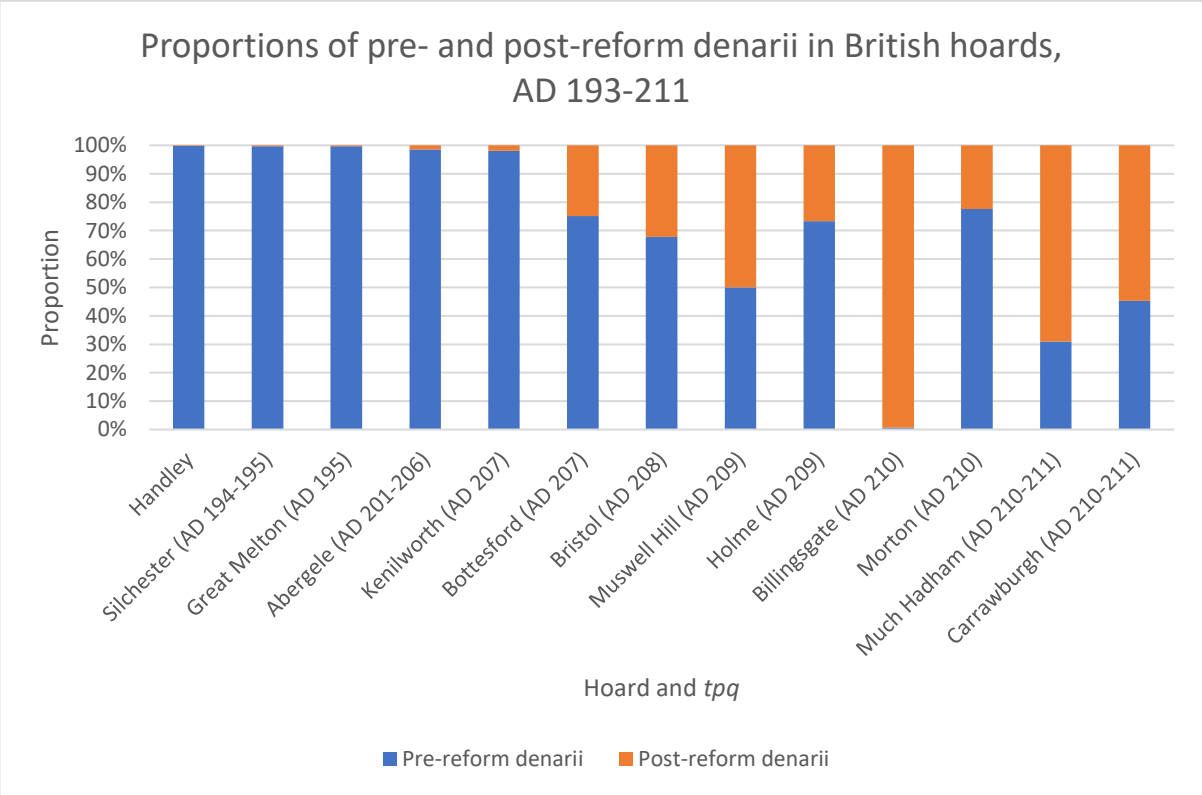


Figure 16: bar graph displaying the data in table 10 (antoniniani omitted for clarity).

During the first decade of Septimius Severus' reign, silver coin hoards in Britain contain an overwhelming predominance of pre-reform coin. The five earliest dated hoards in the current dataset (Handley, Silchester, Great Melton, Abergele and Kenilworth, the latest with a *tpq* of AD 207) contain 98-99% pre-reform coin. The Bottesford hoard (*tpq* AD 207) is noticeably different, containing 75.1% pre-reform coin (127 denarii out of a total of 169). Thereafter hoards tend to be considerably more mixed in composition, with between 30.1% and 77.5% pre-reform denarii in seven of the eight hoards dating between AD 208 and the death of Severus in AD 211.[243] The sole exception is the Billingsgate hoard of AD 210, which contains only 1 pre-reform denarius out of a total of 140 coins. However, it has been argued that this hoard is not representative of the coinage in general circulation at the time of its deposition. Instead it is believed to be the stock of a forger, who would have selected the most recently issued coins to reproduce.[244] This pattern continues into the following decade and the reigns of Caracalla and Elagabalus, with three of four hoards (Chadwell St Mary, Prestwood A and Akenham) containing 41-42% pre-reform denarii. The fourth hoard, the Darfield I deposit with a *tpq* of AD 213, is more heavily weighted towards pre-reform issues at 82.2%.



[243] The remaining hoards of Severus' reign are: Bristol (*tpq* AD 208), Muswell Hill (AD 209), Holme (AD 209), Billingsgate (AD 210), Morton (AD 210), Much Hadham (AD 210-211) and Carrawburgh (AD 210-211.)
[244] Hall (2014) 181-182; Hall (1986) *passim*.

Figure 17: 100% stacked bar chart displaying the proportions of pre- and post-reform denarii found in British hoards with tpq's AD 193-211.

There are clearly two distinct hoard structures for the reign of Septimius Severus in Britain, as demonstrated in figure 17: one with a large majority of pre-reform issues (between 90% and 100%, hereafter referred to as 'Type A' hoards) and the other with a more mixed composition (< 90%, to be referred to as 'Type B' hoards.) Insofar as we can rely on hoard termini to date events, the shift from the former to the latter appears to occur in Britain at some time around AD 207. This pattern was first identified by Richard Reece in his 1987 work *Coinage of Roman Britain*. Reece argues that the slow introduction of new denarii into Severan hoards is representative of the generally sluggish movement of coin from production to circulation in the Roman world. To illustrate his point, Reece compares Severan denarii to the coinage of Antoninus Pius, which likewise reach a peak in representation under Pius' successor Marcus Aurelius around two decades after they were first issued.[245] Later commentators on the hoards of Septimius Severus in Britain, including Jonathan Williams,[246] and Roger Bland and Richard Abdy,[247] broadly agree with Reece's theory.

John Creighton goes one step further, linking the introduction of Severan denarii to British hoards with the invasion of Caledonia in AD 208.[248] The Severan invasion of Scotland was a huge undertaking. Severus likely campaigned with the three legions already stationed in Britain, as well as with most of his Praetorian guard which by this time numbered around 10,000 men. He also possibly brought in the newly raised Legio II Parthica. The existence of several contemporaneous 130-acre forts, which are estimated to be able to accommodate around six legions or 40,000 men, along the line of the Severan advance into Scotland would support the notion of a campaigning force of this size.[249] Septimius Severus and his sons led the campaign personally, and they would have brought along their considerable households and substantial numbers of retainers. Cassius Dio specifically mentioned that Severus brought 'an immense amount of money' with him to fund his Caledonian campaign,[250] and it is possible that this consisted largely of newly minted denarii. This significant injection of cash may then have led to a shift towards Severan issues in the British circulation pool and consequently, in the composition of hoards deposited from this

[245] Reece (1987) 55ff.
[246] Williams (1997) 144-145.
[247] Bland and Abdy (2002) 24-25.
[248] Creighton (2014) 139.
[249] Hodgson (2014) 38-41; Hanson (1978) *passim*; Reed (1975) 96.
[250] Cassius Dio, *Historiae Romanae*, 76.11

point onwards. It is also notable that around the same time the 'legionary denarii' of Mark Antony, which had been largely absent in British hoards from around the time of Antoninus Pius, seem to experience a slight resurgence. In the author's MA thesis it was suggested that the re-appearance of legionary denarii could have been in some way linked to the Severan campaigns in Scotland, and it is possible that the shift towards post-reform issues could be part of the same change in circulation patterns.[251]

The major problem with Creighton's hypothesis is that a similar pattern in changing hoard composition can be observed across the empire, not just in those from Britain. There are eight hoards ending in the period AD 193-211 in the Eastern European dataset. The first five of these hoards (Luiceni, Szombathely, Lujerdiu, Ghirisa I and Sarmizegetusa II, the latest with a *tpq* of AD 201-206) contain 95-100% pre-reform denarii and are thus clearly examples of Type A hoards. The two subsequent small hoards, from Felsodobrol (65 denarii ending with an issue of AD 203) and Virunum (20 denarii ending in AD 208), each contain 47.7% and 40% pre-reform coin respectively, putting them into the Type B category. From this point on the majority of hoards to AD 222 are Type B, with the exceptions being the large Cortanovici and Francesti hoards which contain 80.8% and 99% pre-reform denarii respectively. Given that these two finds are so different from their contemporaries in composition, it is likely that they were created under different circumstances. One potential situation is that these two finds are aggregate coin hoards put together over the course of many year, possibly decades. As such, their creation might have begun during a period in which pre-reform coin was more plentiful. Another possibility is that, as larger hoards, the creator of these two finds was one of the wealthier members of Roman society. As such, they may have had the means and the ability to identify and remove finer silver coins for hoarding in a manner that other hoarders could not. Why this would be the case in Eastern Europe but not in Britain (as far as we can tell from the currently available evidence) is uncertain, but it is mentioned here as a second scenario for consideration.

For the period AD 193-AD 222, fifteen hoards are recorded in the current dataset for the region of Western Europe. These hoards, with the exception of the small Passewaaij (*tpq* AD 205) and Markobel hoards (*tpq* AD 206-210), contain 88%-100% pre-reform coin and thus correspond to Type A hoards. Several of the hoards are very small and as such are of questionable reliability. However, the largest hoards (Breval, Flonheim, Lliria III and Selingenstadt) all contain predominantly pre-reform issues. This apparent preference for

[251] Murphy (2015) 96-117, esp. 112-114.

pre-Severan issues continues into the following decade, with most hoards up to c.AD 222 containing 80-100% pre-reform coin (with the exceptions of the small Mainz III and Baden-Baden hoards, which contain a slight majority of post-Severan issues). The shift towards post-reform denarii occurs later in Western European hoards, during the reign of Severus Alexander (discussed further below.)

The similarities between the British and Continental European hoard evidence does not completely rule out any link between a historical event (i.e. the Caledonian campaigns of AD 208-211) and the change in hoarding patterns observed during the rule of Septimius Severus. However, it does suggest that similar events must have taken place elsewhere. Military campaigning took place in Eastern Europe as part of the civil wars of AD 193-196 and Severus drew many troops from the region during subsequent conflicts. It is possible that injections of military pay into the region early in Severus' reign led to the introduction of post-reform denarii into circulation, and therefore hoards, when previously it had been absent. However, the civil war took place at least a decade before the *tpq* of the earliest Type B hoard in Eastern Europe, so any such connection is tenuous at best. Similar fighting also took place in Italy and Gaul, yet post-reform denarii remain absent in these regions.

In the author's opinion the hoard evidence also contradicts the theories of Reece, Williams, Bland and Abdy. It seems highly unlikely that Severan coin, minted in large quantities between AD 193 and 211, would not enter circulation in substantial numbers anywhere in Britain or Continental Europe (at least as far as can be detected through the hoard evidence) until twenty years or more after it was issued. In all three regions the distinction between the predominantly pre-Severan hoards and those with a more mixed composition is stark, suggesting a sudden shift in hoarding patterns rather than the steady introduction of new coinage issues into circulation as Reece would argue. The comparison with the denarii of Antoninus Pius also seems illusory. In Reece's own dataset, no hoard deposited under Pius contains less than 5% denarii of that emperor and some contain up to c.38%. In the dataset compiled for this thesis and used for the case study of the previous chapter, of hoards with *tpq*'s during the reign of Pius in Britain, Norton (*tpq* AD 143-144*)* contains 7.9% Antonine denarii, Chalfont St Giles 10%, Llanymynech 12%, Londonthorpe 7.9%, Lawrence Weston 12.9%, East Stoke 16.3% and Pyrford (*tpq* AD 159-160) 12.2%.[252] There is no evidence of a dramatic increase in the representation of Antonine denarii in hoards, as

[252] Due to its evidently anomalous composition (discussed below) the Snettisham hoard has been omitted.

there is with the Severan hoard evidence. Rather, it appears that the increase is gradual as new coinage percolated into the circulation pool.

In light of this, an alternative explanation for the composition of hoards under Septimius Severus must be sought. It is apparent that ancient coin users could and would select certain coin types for inclusion in or exclusion from their hoards, and that this choice could sometimes be driven by considerations of fineness (or perceived fineness). Indian hoard finds, containing an overwhelming majority of certain types issued under Augustus and Tiberius, are evidence of this behaviour.[253] The Snettisham 'jeweller's' hoard, dated to AD 155-156, is a similar case from within the boundaries of the empire. Eighty-three denarii and twenty-seven aes coins were found deposited in a single clay pot alongside finished and unfinished pieces of jewellery, cut and engraved gemstones, silver bars, sections of wire, scrap silver, tools and a seal box.[254] Of the 83 denarii, 74 are of Domitian's Period 3 and as such are considerably finer than the denarii being struck when the hoard was closed. The most obvious inference is that the jeweller kept hold of these fine denarii to use as raw material in his workshop. His profession would provide him with the technical skills and equipment to identify finer issues and as a trader in high value luxury goods more precious metal coins would likely pass through his hands in the course of his daily business, creating the ideal conditions for Gresham's Law to operate.

Whether coinage reforms could directly stimulate the creation of selectively composed hoards is harder to determine. Butcher and Ponting claim that that the large number of hoards ending with pre-reform issues of Nero, and the corresponding lack of evidence for hoards ending with post-reform issues, supports the notion of widespread preferential hoarding towards the end of Nero's reign. In particular they highlight the Needham and Warmington hoards as the most likely examples of selective composition, as they both end with some of the very latest pre-reform issues of Nero.[255] Some scholars have even attempted to link denarius hoards with pre-Neronian *tpq*'s to the reforms of Nero, arguing that the exclusion of post-reform issues would make hoards appear older than they actually are.[256] Butcher and Ponting broadly agree with this assessment, mentioning in

[253] de Romanis (2012) 167-169.
[254] Johns (1997) *passim*; Potter (1986) *passim*.
[255] Butcher and Ponting (2015) 226-229; Davies *et al.* (1997) 47 and Ireland (2013) 5 discuss this theory in their publications of the Needham and Warmington hoards respectively.
[256] Hobbs (1992) 21-22; Orna-Ornstein (1997) 23-29 cautions against applying Hobbs' argument to any hoards other than Woodham Mortimer.

particular the Selby hoard which contains silver coins to the reign of Tiberius but *aes* up to the post-reform issues of Nero.

If one of the immediate responses to the Neronian reforms was the widespread hoarding of pre-reform issues, then it is possible that this was repeated following the Severan debasement. In this case, the lack of Severan denarii in Type A hoards is not down to slow coin circulation but due to a deliberate bias against them on the part of coin hoarders. In this case, the termini of Type A hoards may be influenced by the exclusion of newer coin, making it difficult to connect their composition to any specific historical event as in Creighton's work.

The problem with this theory is that it does not explain exactly how the general populace would have become aware of currency modification under Severus. In the case of the Neronian reforms, distinguishing between pre-reform and post-reform issues is reasonably simple due to the considerable reduction in the weight of the denarius and the aureus which accompanied the debasement.[257] The Severan reforms, on the other hand, saw no such weight decrease; in fact, following a period during which the denarius remained at the reduced weight standard used under Commodus, there may have been a restoration of the Neronian weight standard part way through Severus' reign in AD 198.[258] If such an increase did indeed take place, then the majority of Severan denarii would superficially appear to be an improvement on the coinage issued during the preceding fifteen years despite the dramatic reduction in fineness. In turn, we would expect this to lead to the preferential hoarding of *post-reform* denarii, when in reality the opposite can be observed. This suggests that hoarders were aware of the debased nature of Severan denarii despite the appearance of continuity suggested by their weight. Metallurgy, rather than (or of) metrology, was the major concern of coin users following the Severan reforms.

How would coin users have come to notice that a debasement of the silver alloy had taken place, given that this would be considerably more difficult to detect than a change in weight? Epictetus, in the record of his discourses compiled by his student Arrian, discusses several techniques used by coin 'testers,' including sight, touch and smell. He goes into further detail describing how a coinage expert could throw a denarius onto the ground and use the sound it made to determine its quality. Such esoteric methods may have played a role in identifying that a change had been made but would not have provided any details as

[257] Butcher and Ponting (2015) 203-208.
[258] Duncan-Jones (1994) 222; Butcher and Ponting (2012) 77.

to exactly what this change was. It is also possible that the state would advertise that a change to the silver had been made (as we suggested earlier with the coinage of Domitian.)[259] However there is no surviving evidence for this and, as Severus had debased the denarius rather than improved it, it seems to be very unlikely (unless the pronouncement focussed on the slight improvement in weight which may have occurred at around this time.)

Moving to more scientific methods, a simple touchstone would have been ineffective: it would only measure the purity of the outermost layer and the Severan mint continued to artificially enrich the surface of denarii.[260] Surface silvering would also mask the pinkish hue created by adding more than 50% copper to the alloy, making the debasement visually undetectable.[261] Ancient assay methods were difficult, destructive and relatively unsophisticated. Both ancient primary sources on the subject, Pliny the Elder and the author of the Leyden Papyrus X, describe tests which merely differentiate between pure and impure silver.[262] Cupellation, a process to remove impurities from silver ore, was practised in the ancient world and provided a third option for determining the purity of bullion. By melting down a given weight of coins, removing the impurities through cupellation and then weighing the remaining pure silver, the aggregate fineness of large batches of coins could be determined.[263]

Of course, this method would be impractical for the majority of coin users to carry out before general transactions as it is both destructive and requires a significant number of precious metal coins of the same issue. However, where large transactions are concerned, the value of knowledge when it comes to the precious metal content of coins could be significant. By way of illustration, let us take the example of Cicero's famous purchase of a Palatine villa from Marcus Licinius Crassus for 3.5 million sestertii in 62 BC, and assume that a transaction for the same price took place in the reign of Septimius Severus. If the sum were to be paid in denarii, that would total 875,000 coins. Payment in pre-reform denarii of Severus would therefore equal a total bullion weight of 2,021.25kg of silver, while payment in post-reform denarii would only yield 1,365kg, a difference of 656.25kg of precious metal.

---

[259] See *supra* 70.
[260] Gitler and Ponting (2003) 11-14.
[261] Ponting (2009) 272; although Elliott (2014) 138 suggests that this pink tinge might be observable after wear or damage.
[262] Pliny the Elder, *Historia Naturalis* 33.44: Caley (1926) 1157 no.44 and 1165-1166.
[263] Butcher and Ponting (2015) 51.

It is clear that such a significant discrepancy would make it worth the while of parties to such large transactions to engage the services of an expert to advise on the intrinsic value of coin. But these transactions were few and far between, with most day-to-day activity being on a much smaller scale. Would it be worth it to the common coin user to discriminate between denarii of different standards? Koenraad Verboven notes that the average transaction recorded in the tablets of the Sulpicii, a family of bankers from the town of Puteoli active in the mid-first century AD, was around 11,000 sestertii or 2,750 denarii.[264] Payment of this amount in pre-reform Severan denarii would equal a silver weight of 6.35kg, while the use of post-reform denarii would only cost 4.29kg. This is still a significant saving, and perhaps one of even more value considering the more limited means of these coin-users.

The above demonstrates that knowledge of the intrinsic worth of different coin issues could be of significant value to parties in exchange. Monetary experts could fill that gap in the market, with the sacrifice of a number of denarii to cupellation or other destructive assay techniques acting as an investment towards future profit from the sale of knowledge. This knowledge could then filter down from bankers and coinage professionals to the general coin-using public, either through the purchase of their services or through word of mouth.

It is well-attested that money-changers and bankers could be found in any reasonably large Roman settlement, and it is likely that the availability of these services would have increased over time as the economy became more monetised. A possible increase in the availability of monetary services can be inferred from an inscription found at Mylasa, southwestern Asia Minor, dating from AD 210.[265] This fragmentary inscription prescribes financial penalties for individuals caught operating illegal monetary exchanges at the expense of the city-sanctioned banking institutions. The inscription presents the operation of unofficial bankers as a moral evil, but also notes the impact of the dilution of the state monopoly on public revenues. The fact that penalties needed to be imposed at this point suggests an expansion in the availability of black- and grey-market money changing and banking services, making them more widely available (and presumably cheaper) to the general public.

[264] Verboven (2009) 98.
[265] *OGIS* 515; for commentary, see Elliott (2014) 144-146 and Katsari (2011) 136-151.

Money-changers could and did offer differing exchange rates for coins, adding a premium known as an *agio* or *kollybos* to official exchange rates in order to enable them to profit from each transaction. As an example, Verboven notes records of exchange rates for denarii indicating an official rate of 16 asses, with a *kollybos* of between 1 and 2 asses.[266] The similarities between exchange rates across cities and time periods indicates a degree of regulation by local authorities, presumably to prevent price gouging and to enable effective circulation of coinage by protecting the denominational hierarchy. However black-market money changers would be free from such official constraints by their very nature. If unofficial exchanges combined their knowledge of the Severan debasement with their ability to set exchange rates, offering preferential prices for denarii of high intrinsic worth, they may have inadvertently alerted the public to the recent coinage reforms and stimulated the creation of hoards of pre-reform denarii. While it is impossible to determine whether the Mylasa inscription was intended to address such behaviour specifically, or whether similar illicit exchanges were in operation elsewhere in the Roman world, the existence of such concerns around the time of a major change in the coinage is intriguing and potentially revealing of a spread in the black market in currency.

As noted above,[267] another potential reason for popular awareness of coinage reform is the active advertisement of changes by the state for reasons of publicity. The emperor took a particular personal responsibility for the precious metal coinage and its quality (or lack thereof) was often used as a gauge of the the personal worth of the *princeps*. Where the emperor had instigated a change in the coinage he would have been keen to ensure that this was received well by the public, and may have took to propagandising. Such active advertisement could come in the form of 'restored' issues, as under Trajan, or more subtle means. As established above, changes to weight were considerably more noticeable to the average coin user than adjustments to fineness. Severus openly increased the weight of his denarius in contrast to the reduction in silver content. It is possible that this obvious change spurred coin users to scrutinise the value of their coins, perhaps inadvertently flagging up the drop in intrinsic value.

How detailed was the public knowledge of the specifics of the debasement? One interesting aspect of the hoard evidence is that pre-reform Severan denarii, i.e. those issued between AD 193 and 194/195 at 70% fineness, generally do not appear to have been

[266] Verboven (2007) 253.
[267] See *supra* 70 and 127.

preferentially hoarded alongside pre-Severan denarii of similar intrinsic value. When adjusted for the difference in issue period, there are very few hoards in the current dataset which seem to clearly demonstrate preferential hoarding of pre-reform Severan denarii over their post-reform Severan counterparts. This suggests that, while coin users were aware that a debasement had taken place under Severus, they were unaware of exactly which issues were affected and therefore chose to exclude all Severan denarii from their hoards.

This tallies with the impression given by the hoard evidence surrounding the Neronian debasement. Coins on the Second Neronian Standard of 90% purity do not appear to have been preferentially hoarded over those of the First Standard of 80%: hoarders were aware that a debasement had taken place under Nero but could not identify certain Neronian coins which were superior in silver content. A similar pattern was also seen in our earlier case study in the treatment of period 1 and period 3 denarii of Domitian, which generally circulated well together despite the superior silver content of the latter. The literary evidence also supports the notion that the public had limited information on the specifics of currency manipulation. Pliny the Elder, when discussing the debased 'legionary denarii' of Mark Antony, claims that the triumvir 'mixed iron with his denarii.' Pliny correctly identifies a debasement under Antony but is incorrect in the specifics: the actual material used was copper as alloying silver with iron was nearly impossible using Roman metallurgical technology.[268] Cassius Dio does likewise, noting a debasement under Caracalla but erroneously suggesting that the emperor debased the gold with copper.[269]

The hoard evidence also appears to indicate that the trend for preferential hoarding of pre-Severan denarii ended at different points in different regions: around AD 201 in Eastern Europe, AD 207 in Britain and right up to the reign of Severus Alexander in Western Europe. The potential causes of such regionality are difficult to identify. Perhaps this demonstrates that the Roman currency pool was not homogenised across the empire, with regional coin circulation pools as envisaged by Richard Duncan-Jones?[270] Or maybe preferential hoarding was not feasible in Eastern Europe and Britain due to a restricted supply of denarii, a particularly high demand for coin, or both? Such a situation would compel coin users to exchange whatever currency came to hand and restrict their ability to be selective. Butcher

[268] Pliny the Elder, *Historia Naturalis* 33.46.132; Butcher and Ponting (2015) 162.
[269] Cassius Dio, *Historiae Romanae* 78.14.4; Elliott (2014) 145; Bland (1996) 74-75.
[270] Duncan-Jones (1994) *passim*; Duncan-Jones (2001) *passim*; Duncan-Jones (2002) *passim*; *contra* Howgego (1994) *passim*; Howgego (2002) *passim*.

and Ponting argue that this scenario could come about during an expansion of the monetary economy, of the kind that Dominic Rathbone proposes took place in 3rd century AD Egypt.[271] If similar monetisation processes were underway in Eastern Europe or Britain at the time, and the supply of coinage was not increased sufficiently to keep up with demand, then coin users could have been forced to stop selectively hoarding certain coins. This would also go a small way to explaining the lack of identifiable price inflation prior to AD 270, despite the evident increase in mint output from Severus onwards.

Did Severus' reforms affect the movement of Roman coinage beyond the frontiers of the empire? One of the potential outcomes in the traditional formulation of Gresham's Law is that undervalued coins would move to areas where they would be treated as bullion. It is generally believed that beyond the frontiers of the empire, especially in the Northern European barbaricum, Roman coins were used as prestige items, jewellery, gifts or ritual objects rather than as currency. This is supported by a variety of evidence: the context of the finds, the lack of base metal coinage, the large number of coins which have been pierced or otherwise altered to allow them to be worn, and so on. These seem to be ideal conditions for Gresham's Law, but does this tally with the surviving evidence?

Several denarius hoards dating to the late second and early third centuries have been found beyond the Roman frontier in Caledonia (modern Scotland). An analysis by Nicholas Holmes shows that these hoards are similar in composition to contemporary deposits from the Roman regions of Great Britain, indicating that they were drawn from a similar pool of circulating coinage. The composition of the hoards generally begins around the time of the Neronian reforms, with the bulk of coinage coming from the Flavian and Antonine periods before tailing off towards the end of the second century.[272] Only two post-Severan hoards from Caledonia are known to the author, the Edston hoard of AD 218-222 and the Falkirk hoard of AD 230. Both hoards are noted for their unusual composition when compared to contemporary hoards from south of the border,[273] and Richard Reece has proposed that the Falkirk hoard may in fact have been a Severan deposit which was 'topped up' with a small number of post-Severan denarii.[274] All of this indicates that Roman denarii drawn from general circulation were moving beyond the frontiers in the later second and early third centuries, before the flow was stopped under Septimius Severus and his immediate

[271] Rathbone (1996) *passim*.
[272] Holmes (2006) 9-12.
[273] Holmes (2006) 13.
[274] Reece (2003b) *passim*.

successors. The evidence from the Northern European barbaricum is largely similar, with an end to denarius movement during the reign of Septimius Severus.[275]

How and why did this movement occur? External trade, such as that attested with India and the East, provides an obvious contender. Long distance trade took place on a vast scale throughout the period under discussion, and large quantities of precious metal coinage would have been transferred in order to supply the Roman populace with luxury goods.[276] Several Roman writers describe local people in foreign lands as keen to acquire Roman currency, with Pliny the Elder describing a Sri Lankan king as being impressed with the standardised weights and finenesses used for denarii.[277] While we must always take the comments of ancient authors with a pinch of salt, this does tally with the number of denarii and other coins found beyond the frontier and even explicitly suggests that the desire for Roman coinage was driven by considerations of purity. However, it must be remembered that these coins, while moving beyond the frontiers through trade and exchange, did not necessarily continue to function in the same way once outside of the Roman sphere as will be discussed further below.

Military campaigning is another popular explanation for the presence of Roman coin hoards beyond the frontiers. For example, hoards in Caledonia were often thought to have been remnants of military campaigns under Antoninus Pius and Septimius Severus.[278] This theory had become less popular due to the difficulty of dating hoards with precision, and due to the fact that there is often a marked difference in composition between the coin hoards and site finds found in the same region. To continue with the Scottish example, a large proportion of the site finds from the Severan-era military forts of Carpow and Cramond were post-reform Severan denarii, contrasting with the lack of such coins in the contemporary hoards from Birnie, Portmoak, Megray and others. Assuming the site finds at Cramond and Carpow to represent the coinage used to pay the soldiers during the Severan campaigns, this suggests that military pay was drawn from a different pool of coinage from that used to create the hoards.[279] However, it is entirely possible that the post-reform coins

---

[275] The literature here is necessarily extensive, but a summary is provided in Holmes (2006) 13-16.
[276] See for example the much-discussed comments on the volume of eastern trade by Pliny the Elder in *Historia Naturalis* 12.41; the Muziris papyrus (P. Vindob. G 40822) which documents the transport of a cargo of spices and other goods valued at approximately nine million sesterces from India to Egypt aboard the freighter *Hermapollo*n [Casson (1990)]; and the abundant archaeological, material and epigraphic evidence for long-distance trade at cities such as Palmyra [Gawlikowski (1994).]
[277] Pliny the Elder, Historia Naturalis 6.24.84-85.
[278] A recent reiteration of this argument can be seen in Robertson (2000) xxvi.
[279] Holmes (2006) 12, summarising his own publications of the finds from Carpow (in Dore and Wilkes (1999) 528-535) and Cramond (Holmes (2003), which have been more recently examined in

used as pay were excluded from hoards while still being used and lost in day-to-day exchange, leading to the contrast between site finds and hoards.

More recently, scholars have proposed that hoards within the barbaricum may have been influenced by the nature of political contact between the Roman empire and neighbouring tribes.[280] Aleksander Bursche has studied the coin find evidence and noted periods of waxing and waning in the transfer of coins between the empire and the barbaricum, and subsequently has produced a framework which attempts to explain these patterns.[281] In Bursche's model, the numerous hoards of denarii within the barbaricum which end prior to or around the beginning of Severus' reign represent a continuous flow of coin used in trade, primarily for amber.[282] However, a decline in the availability of silver at the beginning of the third century combined with an increase in the quantity of coinage required to pay for the army is alleged to have increased the value of silver coinage within the empire, and made it unlikely to have been transferred beyond the frontiers for economic reasons (with bronze coins, glass beads and similar objects being traded instead.)[283] This may have been coupled with an official ban on the transfer of silver coinage outside the empire, but as such ordinances were frequently flouted it is likely that economic considerations were more effective.[284] This hiatus in the movement of denarii can be seen in the lack of hoarded silver coins in the barbaricum from around AD 193/194 onwards. Subsequent finds of silver coins appear sporadically, thus Bursche believes that these hoards represent subsidies paid to tribes to ensure their support or neutrality, ransoms for war captives, troves of booty captured during raids on Roman territory and the like.[285] The fact that the majority of such finds are located relatively close to the frontiers, with distant regions continuing to receive a limited supply of silver, lends support to this theory as the Roman authorities would naturally have been more concerned with maintaining the goodwill of tribes closer to home.[286] In this model, Gresham's law is unable to operate as we would expect as the rising

---

Holmes (2017).) In contrast to the Birnie hoards, Holmes suggests that the recently discovered hoard of 79 denarii found at Kippilaw (*tpq* c.AD 207), which contains a much higher proportion of unworn Severan coin and has a similar composition profile to contemporary hoards from within the province of Britannia, may be linked to military activity; Holmes (2014).

[280] Supporters of this line of inquiry include Todd (1985), Bursche (1986), Berger (1996), Holmes (2006) and Hunter (2007), amongst others.

[281] Described in Bursche (1986) *passim* and Bursche (1996) 123-134.

[282] Bursche (1996) 123, although he notes at p102 n.27 that it is an oversimplification to associate all denarius finds prior to AD 194 with the amber trade.

[283] Bursche (1986) 284; Bursche (1996) 124-125.

[284] Bursche (1996) 124; *contra* Kolendo (1980) *passim*.

[285] Bursche (1996) 127-129.

[286] Bursche (1996) 128.

value of silver and the availability of alternative goods has made it simply too expensive to be used in long distance trade.

This theory is attractive as it explains several facets of the coin find evidence: the steady stream of denarii entering the barbaricum during the later second century, the abrupt and almost universal end to the transfer of Roman silver coinage during the early third century despite the ongoing movement of *aes* coins and trade goods, the large but intermittent finds of Roman silver coins within the barbaricum dating from the mid to later third century and so on. But does this preclude the possibility that denarii moved beyond the frontiers as a result of debasement? Acceptance of the 'subsidy' theory is often coupled with a rejection of the effect of debasement on coin movement, usually on the grounds that it would be difficult for tribes to distinguish the poorer-quality issues from those of superior intrinsic value. As we have seen, ancient assay techniques were far from precise but it is entirely possible that the tribes would have had access to these skills.[287] They would have been particularly keen to establish the silver content of the coinage if it was to be used as bullion or jewellery, as appears to have been common. If the coins were not to be used as money and instead were to be used as bullion or as raw material in the production of jewellery, then barbarian smiths would naturally be less concerned about destructive cupellation of the denarii they received. The willingness to utilise this more accurate method of assay may have led to a greater awareness of coinage changes in the barbaricum than within the empire itself. Knowledge of the debasement of AD 194 within the empire, however imperfect, may also have percolated out to frontier tribes. All of this may have added up to a bias against post-reform denarii within the barbaricum, leading to their exclusion from subsidies and trade and thus from hoards.

In his review of Bursche's 1996 work, G.L. Duncan argues that, while making a strong argument for a political motivation for the movement of coins beyond the frontiers in the third century AD, the theory fails to disprove alternate explanations for coin flows such as trade or changes in coin production patterns.[288] Duncan believes that such explanations can be proven or disproven through the comparison of various regions outwith the empire, not

[287] The metalworking techniques of the barbarian tribes were highly advanced, as can be seen in the finds of high quality metal objects produced in the regions beyond the frontiers (see for example the torcs and other objects found in the pre-Roman Snettisham treasure from Norfolk; Meeks *et al.* (2010)). Given the complex craftsmanship displayed in such items, it seems entirely reasonable to suppose that reasonably advanced metallurgical techniques were also in use.
[288] Duncan (1999) 378-379.

just those from Northern Europe.[289] To provide this contrast, closer examination of the Caledonian hoards may prove beneficial.

Superficially, the Caledonian silver hoard profile is broadly similar to that found in the continental barbaricum: a steady number of finds dating to the second half of the second century AD 194, with only a few sporadic large hoards between AD 194 and the later third century. This would appear to lend support to Bursche's hypothesis. Can the same be said when the contents of the hoards are examined in more detail?

One major difference between the Caledonian and Roman hoards within the province of Britannia can be seen in the numbers of 'legionary' denarii of Mark Antony. These are found in small numbers in most Roman hoards deposited under Severus but are completely absent in their Caledonian counterparts.[290] This indicates that the 'legionary' denarii were either not selected for transfer to the north, were not acceptable to the Scottish tribes or both. Holmes takes this as evidence that the two groups of hoards were drawn from different pools of coinage. Having discounted a military origin for the Caledonian hoards, Holmes proposes that they represent tribal payments taken from the same coinage pool as the hoards found in the continental barbaricum, which likewise lack a significant number of legionary denarii (although this is perhaps less notable as legionary denarii seem to be very rare in continental hoards from within the empire deposited around this time too.)

Given that the 'legionary' denarii were widely thought of as 'base,'[291] this suggests that the selection of coins transferred to Caledonia (as subsidies, in trade or for other purposes) may have been tied in part to the intrinsic value of denarii (or at least the perception of it). It may also support the proposal that the Caledonian hoards are connected to the military activity under Severus and Caracalla, in that the pool of coins used to create the hoards appears to have come from a source outside the British Isles. If said source was in continental Europe, the absence of legionary denarii is unremarkable as they appear to have all but left circulation in most areas of the western continent by this time.

To conclude, the so-called 'Great Debasement' of Septimius Severus appears to have triggered an episode of preferential hoarding of pre-reform denarii across the Roman

---

[289] Duncan (1999) 378.

[290] Holmes (2006) 10; Holmes notes at p. 13 that two Caledonian hoards which postdate the reign of Severus contain legionary denarii, although not in huge numbers (17 in the Falkirk hoard and 13 in the Edston hoard.)

[291] Murphy (2015) 22 and 67-68; despite this popular opinion, legionary denarii were in fact much purer than most denarii minted from the reign of Trajan onwards.

world. This suggests that the contemporary public were both aware of the changes and concerned enough by them to take action to conserve the bullion value of their denarii. It is difficult to identify how the public would have become aware of the reforms, given the continuation of surface silvering of denarii at the Roman mint and the difficulty and expense of ancient assay methods. Details of the debasement, such as the finer nature of Severus' earliest denarius issues, appear to have gone unnoticed, suggesting that the public were aware of the reforms on a general rather than a specific level. All regions follow a pattern of an initial period of preferential hoarding of fine denarii, followed by a period of more mixed hoard composition. The length of this initial phase varies between regions, for unknown reasons. Hoards of predominantly pre-reform denarii largely disappear from the record by the reign of Severus Alexander across the empire, a pattern which will be discussed in the following section. Overall, the response to the Severan reforms can be compared to the events following the Neronian debasement which preceded them, suggesting that similar economic and monetary forces were in operation during the first and the third centuries AD.

Severus Alexander (AD 222-235)

Region	Number of hoards	Number of coins	Pre-Severan denarii	Septimius Severus pre-reform	Septimius Severus post-reform	Caracalla denarii	Caracalla antoniniani	Post AD 217 denarii	Post AD 217 antoniniani
Britain	4	13,269	3,543 (26.7%)	151 (1.1%)	7,284 (54.9%)	754 (5.7%)	66 (0.5%)	1,427 (10.8%)	44 (0.3%)
Western Europe	14	3,859	1,102 (28.5%)	146 (3.8%)	1,377 (35.7%)	229 (5.9%)	9 (0.2%)	983 (25.5%)	13 (0.3%)
Eastern Europe	9	4,209	1,944 (46.2%)	78 (1.9%)	1087 (25.8%)	228 (5.4%)	3 (0.1%)	862 (20.5%)	7 (0.2%)
The East and North Africa	0	-	-	-	-	-	-	-	-
Total	27	21,337	6,589 (30.9%)	375 (1.8%)	9,748 (45.7%)	1,211 (5.7%)	78 (0.4%)	3,272 (15.3%)	64 (0.3%)

Table 12: a summary of hoard evidence for the reign of Severus Alexander, AD 222-235.

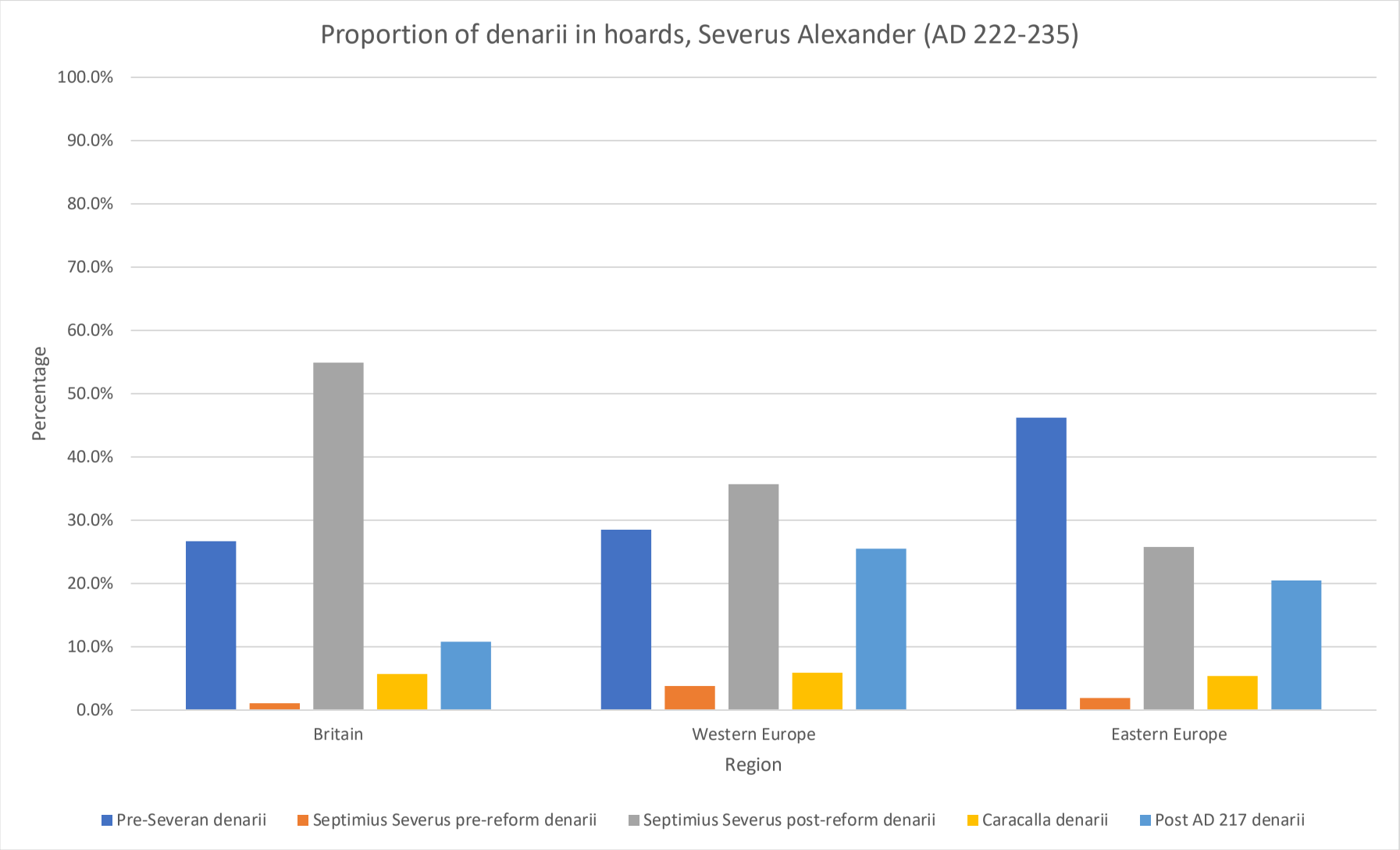


Figure 18: bar graph displaying the data in table 11 (antoniniani omitted for clarity).

Severus Alexander was the last of the Severan dynasty of emperors, and the final emperor before the start of the period most commonly recognised as 'The Crisis of the Third Century.' As such, his reign (or more specifically, his assassination and the accession of his immediate successor Maximinus I 'Thrax') is often seen as a political, military and economic milestone in the shift from the early 'Principate' to the later 'Dominate'.[292]

Previous metallurgic studies have indicated that the denarius may have been modified during the reign of Alexander. However, in terms of scope, this is often regarded as part of a continuing decline rather than as a major discrete debasement as under Nero, Domitian or Septimius Severus. Lawrence Cope's review of metallurgical studies of the silver coinage suggests that Severus Alexander minted silver using an alloy of around 42% purity, a slight decline from the 46% of Septimius.[293] A chemical analysis undertaken under the direction of Richard Reece identified the years around AD 220 as the beginning of a decline in the quality of the silver coinage which continued until AD 231.[294] David Walker's more detailed results suggest two phases of silver coinage under Severus Alexander; the first, from AD 222-227, using a 42% alloy while the second, from AD 228-235, using a finer alloy of 42-49% silver.[295] All of these results suffer from the inaccuracies brought about by surface silvering and corrosion, as discussed by Cope and admitted to by Reece, and updated fineness data from the ongoing project by Butcher and Ponting is eagerly awaited. Despite this, even if there was a debasement at this time the reduction in the silver standard would have been so slight as to be almost impossible to detect and should not be expected to alter the circulation pattern of the denarius in any meaningful way.

Metrologically, Michael Crawford notes that Severus Alexander reduced the weight of the denarius in addition to debasing its silver content, again identified as part of a general deterioration in the standard of the coinage rather than as a significant overhaul.[296] Richard Duncan-Jones proposed a slight decline in the weight of the denarius under Severus Alexander when compared to those of Septimius Severus and Caracalla.[297] The mean weight of Severus Alexander's denarii in Duncan-Jones' survey of the Viuz-Faverges hoard is 3.09g, compared to 3.36g for Septimius Severus and 3.23g for Caracalla. As noted above, it is almost impossible to accurately identify the target weight for Roman coins given the

[292] See the discussion of the Crisis of the Third Century *supra* 113-115.
[293] Cope (1967) 111, reporting the results obtained in Carter (1964).
[294] Reece (1968) 113.
[295] Walker (1978).
[296] Crawford (1975) 569.
[297] Duncan-Jones (1994) 225 table 15.5.

effects of the best part of two millennia of corrosion.[298] However, if there was a reduction in weight then we may expect some response from the coin-using public; as noted in our earlier case studies, weight changes were easier to detect and often led to preferential hoarding and removal of heavier silver coin (in this case, pre-reform and early Severan denarii).

In other monetary developments, Roger Bland has identified the reign of Severus Alexander as the point at which a consistent target weight for the aureus was largely abandoned.[299] The weights of individual aurei under Severus Alexander show a much higher degree of variance than those of his predecessors, setting a trend which would continue for the remainder of the third century. Bland takes this as evidence for the abandonment of a fixed relationship between the gold and silver coinage, instead moving towards a floating valuation of gold currency based on metal content.

Perhaps surprisingly for a reign which appears to have encompassed numerous monetary changes, which is seen as a watershed in the transition from 'High' to 'Late' empire, and one positioned on the cusp of a purported revolution in the Roman economy, very few monetary or economic studies devoted to the reign of Severus Alexander have been produced. Crawford discusses the period as part of his overview of Roman economics from Commodus to Constantine.[300] Duncan-Jones includes Severus Alexander as the final emperor in his survey in *Money and Government*, but not in the same depth as compared to his Severan predecessors.[301] Other scholars mention changes to the gold and silver currency under Alexander as part of a continuing narrative of debasement from Septimius Severus into the latter third century, but do not give the period any major consideration.[302] A detailed review of economic developments at the end of the Severan dynasty is long overdue. This is beyond the scope of this thesis, but we can hopefully contribute to filling this deficiency by providing an overview of the composition of the extant silver hoard evidence.

There are four substantial British hoards in our dataset which end during the reign of Severus Alexander, all falling within the decade AD 223-232.[303] These hoards contain a total

---

[298] See *supra* 18-19.
[299] Bland (1996) 69-71.
[300] Crawford (1975) *passim*.
[301] Duncan-Jones (1994) *passim*.
[302] For example, Haines (1941) 33-34, Alföldy (1974) 92 and Bland (1996) 69-71.
[303] These are Colchester (*tpq* AD 223), Shapwick (AD 224), Llanarmon (AD 226) and St Mary Cray (AD 226).

of 13,269 silver coins, of which 3,694 (27.8%) are pre-reform denarii. This is a major decline from the previous decade, wherein hoards contained an average of 66.2% pre-reform coin. It could be expected that such a drop in the proportion of pre-reform coin may be due to large numbers of Severus Alexander denarii entering the circulation pool, and indeed these do now enter hoards in significant numbers (post-AD 217 denarii make up 10.8% of silver coins in hoards during this period). However, our evidence seems to suggest that the biggest proportional increase amongst coin groups is found in the post-reform issues of Septimius Severus, which now make up 54.9% of coins in hoards (a 24.6% increase on the previous period). Post-reform denarii of Septimius Severus continue to significantly outnumber those issued by him on pre-reform standards. This is the case when compared both in terms of absolute proportion of all coins in the hoard (54.9% to 1.1%) and when adjustments are made for differing issue periods using the method described above (11.7% to 2.2%).[304]

The decline in the proportion of pre-reform denarii in hoards is potentially highly significant. While these coins are still present in large numbers and remain a considerable component of the silver coinage in circulation, they are no longer the preeminent standard of denarii in use in Britain. The abrupt nature of this change indicates that more forces than the natural wastage of older coin may have been a factor at this time.

It has been proposed, most recently by Kevin Butcher, that the introduction of the antoninianus by Caracalla in AD 215 was the third century equivalent of the restoration of the pure denarius by Domitian in AD 82.[305] This theory will be discussed further in the following chapter, but if we accept it for now then it is possible that the end of antoninianus production and the rapid wane of the pre-reform denarius under Severus Alexander is the equivalent of the Domitianic reforms of AD 85. The narrative goes as follows; a debasement of the denarius creates two circulating silver coinage standards, the two standards are unable to circulate effectively together due to the action of Gresham's Law and unofficial two-tier exchange rates, the mint attempts to revert to the older standard to stabilise the monetary system, the restoration is unsuccessful due to the issues which forced the original debasement in the first place and the only other solution is to withdraw the older standard from circulation and return to producing issues on the debased standard.

[304] See *supra* 116-117.
[305] Butcher (2018) 178.

One test to determine whether the reduction in the number of pre-reform denarii in British hoards under Severus Alexander was due to a concerted recall of older coins would be to identify whether an episode of coinage recycling can be detected at this time. As discussed in the previous case study, recycling of older coin was a common practice from the reforms of Nero onwards. However, following the withdrawal of Republican denarii under Domitian, Nerva and Trajan, elemental analysis of denarii of the latter demonstrates that these coins were recycled *en masse* into newer issues on a lower standard. Unfortunately, such analyses have not yet been carried out on denarii of Severus Alexander, but it is hoped that the continuing work of Butcher and Ponting will encompass this potentially fruitful area of research. For now, an alternative approach must be taken.

If the decline of pre-reform denarii in British hoards is due to a large-scale recall of older denarius issues, then naturally we would expect to see similar changes in the composition of hoards from across the empire. As with the recall under Domitian and his successors the effects of such activity may not necessarily be seen in hoards of all regions at exactly the same time and to the same extent. However, given the length of the reign of Severus Alexander, we should expect that at least some decrease in the proportion of pre-reform denarii in hoards should be evident across the empire during his reign.

Fourteen hoards from Western Europe end with coin of Severus Alexander, all of which were deposited in the Roman regions of modern Germany.[306] These hoards contain a total of 3,859 coins, of which 1,248 (32.3%) are pre-reform issues. The decline in the proportion of pre-reform coin from the hoards of the previous decade is even more stark than in Britain at 63.3%. The coins filling the gap are split between the older post-reform issues of Septimius Severus (35.7%, an increase of 29.7%) and Caracalla (5.9%, an increase of 4.9%)[307] and the newly struck coin of Elagabalus (13.5%, an increase of 13.3%) and Severus Alexander himself (11.5%). Interestingly, the adjusted proportions of pre- and post-reform denarii of Septimius Severus continue to be very closely aligned in Western European hoards, at 5.5% and 5.7% respectively (in the previous decade they were even at 0.7%).

[306] Mainz IV (*tpq* AD 222-228), Kempten-Lindenburg (AD 222-228), Pfunz (AD 222-235), Heidelberg (AD 222-235), Baden-Baden (AD 222-235), Unterdigisheim (AD 222-235), Welzheim (AD 222-235), Sigmaringen (AD 228), Eining 1 (AD 228-231), Kempten-Spinnerei (AD 228-231), Munchen-Harlaching (AD 229-231), Kirchmatting (AD 231), Marnbach (AD 231-235) and Wiggensbach (AD 231-235).

[307] The number of denarii issued under Macrinus are relatively minimal in these hoards.

Nine hoards containing a total of 4,209 coins make up the current dataset for Eastern Europe.[308] Of these, 48% (2,022) are pre-reform denarii, which superficially appears to be a huge decline on the 93.5% on the previous decade. However, the results for AD 213-222 are largely based on the substantial Francesti hoard which, as mentioned above, contains an overwhelming majority of pre-reform coin (at 99%), and as such must be taken under advisement. The proportion of post-reform Severan denarii increases more modestly than in Britain and Western Europe, from 16.7% to 24.6% (in the decade AD 203-212 this proportion was 20.3%, so the increase may be even less significant). In common with the other two regions reviewed above, post-AD 217 denarii enter circulation in significant numbers at this time and make up 27.4% of coins in hoards deposited during the decade.

There are no hoards ending AD 223-232 in the current dataset for the East and North Africa region, so comparison between this area and the remainder of the empire will not be possible.

As can be seen from the above, there is a major drop in the proportion of pre-reform denarii in hoards across the Roman empire during the reign of Severus Alexander. This provides support to our hypothesis that the end of antoninianus production under Elagabalus in AD 219 was accompanied by a recall of older pre-Severan reform issues which continued under his immediate successor. Of course, this theory is limited in that it is based on purely circumstantial evidence inferred from the extant hoard evidence. It is not supported by the literary evidence or modern scientific work in the same manner as the recall under Domitian and his successors. It is also not a complete parallel; the pre-reform denarius does not completely vanish from hoards during the reign of Severus Alexander as the Republican denarius does during the reign of Trajan (although as our earlier analysis showed, it could sometimes take decades for recalled issues to be entirely removed from the circulation pool.) However, it does provide a potentially productive line of future inquiry, as well as beginning to explain the rationale behind the introduction of the Caracallan antoninianus and its subsequent chequered history.

At the time of Domitianic coinage recall, examination of composition of individual hoards indicated that there may have been some preferential hoarding of Republican and Julio-Claudian denarii in the period immediately prior to their withdrawal, most notably in

[308] Barza (*tpq* AD 222-228), Camplung-Muscel (AD 222-235), Ptuj (AD 222-235) Nires (AD 227), Turda II (AD 228-231), Tisa (AD 229), Ercsi (AD 231), Deleu (AD 231-235) and Borgond (AD 232)

Britain under Hadrian.[309] It was proposed that this was due to the recall spurring recognition of the superior intrinsic value of the earlier coin, bringing Gresham's Law into effect. Observation of the same effect here may help to strengthen the parallels between the two series of reforms and lend further weight to our hypothesis of a late Severan coin recall.

The British hoard evidence provides no such parallel. The proportion of pre-reform denarii in the four hoards deposited under Severus Alexander declines in correlation with the date of deposition; from 35.5% in the Colchester hoard of AD 223, through 25.7% in the AD 224 Shapwick hoard to 25% and 19.2% respectively in the Llanarmon and St Mary Cray deposits ending with coin of AD 226. Admittedly this is a limited timespan within the 13-year reign of Severus Alexander, but it seems to suggest that no major episode of preferential hoarding of pre-reform coin took place in Britain prior to a coinage recall under Severus Alexander.

Results in other regions are less clear-cut than in Britain, but again would support the notion that there was no period of preferential hoarding of older silver coin under Severus Alexander. As can be seen in the graphs below, coin hoards from Western Europe and Eastern Europe both demonstrate a rapid but steady downward trend in proportions of pre-Severan reform denarii during the reign of Severus Alexander, with no pre-decline spike in hoarding.

It could be the case that the preferential hoarding of pre-reform denarii which took place during the reign of Septimius Severus and his successors, discussed above and evidenced by the Type A hoards found across the empire, is key here. As reviewed in previous chapters, extant hoard evidence suggests that the reforms of Nero led to sporadic preferential hoarding of Republican and early Julio-Claudian denarii.[310] However this was not uniform or extensive, a feature ascribed here to incomplete public knowledge of the reform at the time. As already discussed, the Severan reforms led to a much more widespread outbreak of preferential hoarding due to heightened sensitivity to coinage modification.

If such large-scale preferential removal and hoarding of fine second century denarii had recently taken place at the time of a coinage recall under Severus Alexander, it is entirely possible that the proportion of pre-reform denarii in the circulation pool had decreased to

[309] See *supra* 65-66.
[310] See *supra* 51-53.

such an extent that even higher rates of preferential hoarding were not possible. As such, this apparent disconnect between our parallel narratives may be a product of the effects of increased public sensitivity to coinage reforms in the third century AD when compared to the first and second centuries and need not stand as a black mark against attempts to equate the two series of reforms.

One interesting point to note is that the decline of pre-reform denarii continued to be limited to pre-Severan coin. Proportions of pe-reform issues of Septimius Severus, issued on the same standard as the finer second century denarii, remain steady in hoards when compared with those of the previous decade. In British hoards, the proportion of pre-reform denarii of Septimius Severus is down only slightly from 1.7% in AD 213-222 to 1.1% in AD 223-232, compared to a drop of 39.6% in the proportion of pre-Severan denarii. A similar pattern can also be seen in continental Europe, where the proportion of pre-reform denarii of Septimius Severus actually increases in hoards of Western Europe (0.7% to 3.8%) and Eastern Europe (1.5% to 2%). Taken together, this would suggest that whatever caused the decline in the number of circulating second century AD denarii did not affect the coin of the same standard issued by Septimius Severus.

Given that the pre-reform issues of Septimius Severus were identical in appearance to his post-reform coin, and that the debasement of the coinage was largely metallurgical rather than metrological in nature, it is possible that the public remained largely unaware of the precise date at which denarius standards changed. As such, it may be the case that all Severan denarii were treated as post-reform issues by the populace, preventing the pre-reform issues from being selectively removed at a more rapid rate. This tallies with the find evidence from the reign of Septimius Severus himself, which as discussed above saw no preferential hoarding of pre-reform Severan coin alongside second century denarii. The evidence continues to support our hypothesis that only major changes in silver content or variations in the weight of denarii would have been detectable by the majority of coin users.

To summarise, the hoard evidence for the reign of Severus Alexander shows a dramatic decline in the proportion of pre-Severan reform fine silver denarii in circulation across the Roman empire. It is here proposed that this is representative of a parallel between the Severan era reforms and those which took place between the reigns of Nero and Trajan. The scale and rapidity of the removal of pre-reform denarii from the circulation pool suggests state action through a recall of older denarii under Severus Alexander, rather than

the effects of natural wastage of coin population and the preferential hoarding seen under Septimius Severus. Severus Alexander initiated a coinage recall in an attempt to remedy unforeseen economic issues brought about by the reforms of Septimius Severus, with the previous attempt by Caracalla to resolve the problem through the introduction of the antoninianus having been unsuccessful. Logically, acceptance of a parallel between the Severan period coinage reforms and those of Nero/Domitian/Trajan would also suggest that the production and circulation of the antoninianus would be hampered by the same problems which hamstrung the pure Domitianic denarius of AD 82-85, namely the number of post-reform coin in circulation and the economic circumstances which led to the debasements of Nero and Septimius Severus. This scenario will be examined further in the next chapter.

Unlike the recall under Domitian and Trajan, Severus Alexander's actions do not spur an episode of widespread hoarding of fine silver coin. This however is reflective of increased popular knowledge and concern around debasement in the third century AD having stimulated such activities around the time of the original debasement rather than when the issue was highlighted by a recall. As such it need not be evidence of a deficiency in our hypothesis. We would now expect to see pre-reform denarii rapidly disappear from circulating during the following decades, to be recycled into newer coin.

Maximinus I – Gordian III (AD 235-244)

Region	Number of hoards	Number of coins	Pre-Severan denarii	Septimius Severus pre-reform	Septimius Severus post-reform	Caracalla denarii	Caracalla antoniniani	Post AD 217 denarii	Post AD 217 antoniniani
Britain	4	1,727	252 (14.6%)	50 (2.9%)	508 (29.4%)	95 (5.5%)	5 (0.3%)	804 (46.6%)	13 (0.8%)
Western Europe	11	7,285	1,516 (20.8%)	97 (1.3%)	2,274 (31.2%)	704 (9.7%)	115 (1.6%)	2,497 (34.3%)	82 (1.1%)
Eastern Europe	15	4,121	748 (18.1%)	101 (2.5%)	1,220 (29.6%)	222 (5.4%)	8 (0.2%)	1,578 (38.3%)	244 (5.9%)
The East and North Africa	2	671	6 (0.9%)	54 (8%)	411 (61.3%)	91 (13.6%)	0 (0%)	109 (16.2%)	0 (0%)
Total	32	13,804	2,522 (18.3%)	302 (2.2%)	4,113 (29.8%)	1,112 (8.1%)	128 (1%)	4,988 (36.1%)	399 (2.9%)

Table 13: a summary of hoard evidence from Maximinus I to Gordian III, AD 235-244.

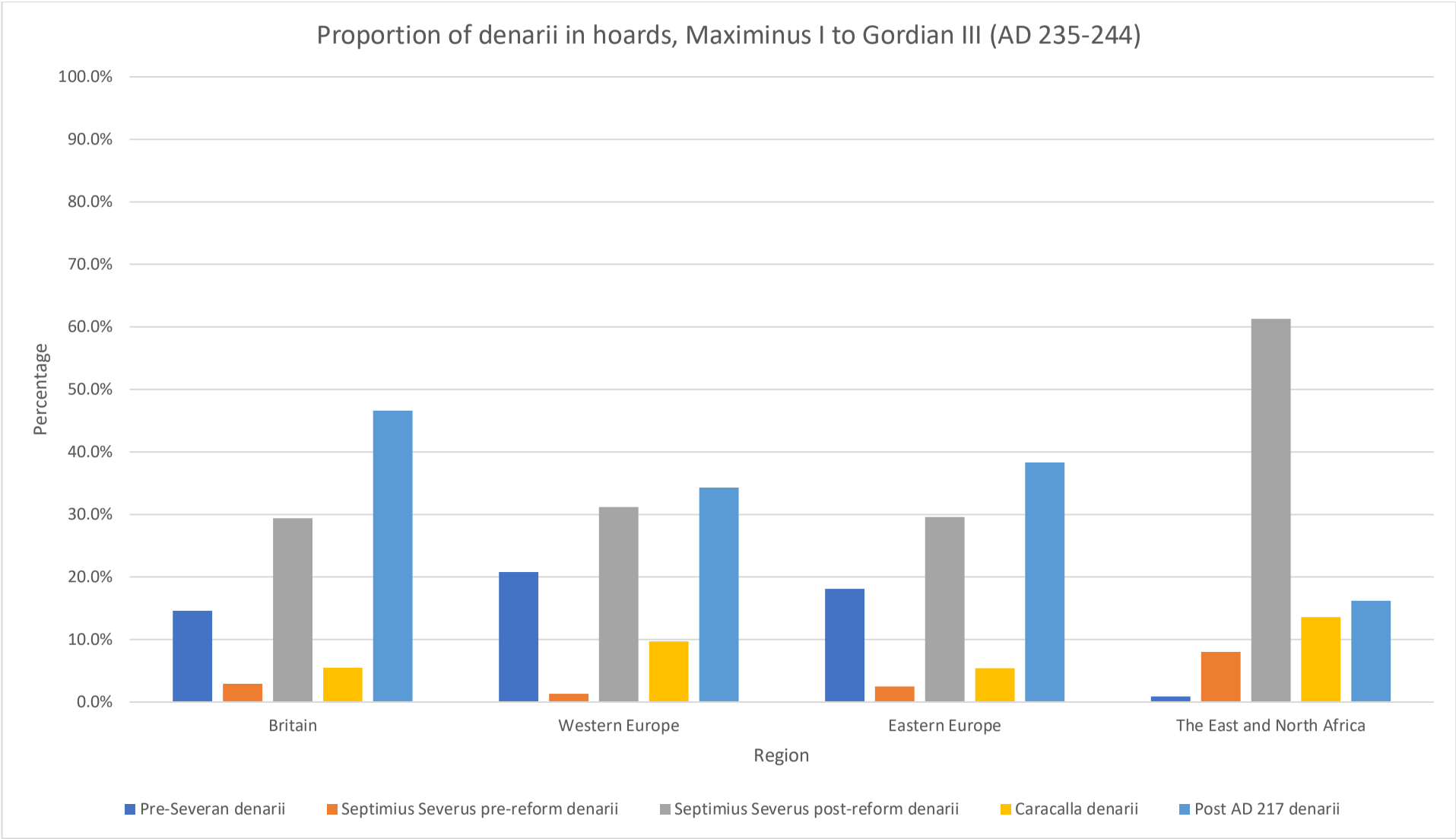


Figure 19: bar graph displaying the data in table 12 (antoniniani excluded for clarity).

The death of Severus Alexander, assassinated by his own troops while campaigning against the Germans at Mainz, and his replacement by the Thraco-Roman military commander Maximinus I 'Thrax' heralded the commencement of a period marked by the role of the military in appointing and deposing emperors. The rise of these so-called 'barracks emperors' is held to be the start of the 'Crisis of the Third Century,' ending only upon the accession of Diocletian in November of AD 284.

The decades following the reign of Severus Alexander also saw a watershed in the production of Roman silver coinage. At the beginning of the period, the denarius was the principal denomination in circulation and the only one in production. An attempt was made to reintroduce the antoninianus by Balbinus and Pupienus, but this was limited to one issue at the end of their short reign.[311] However by the end of the reign of Gordian III, denarius striking had almost completely ended never to be revived (with the exception of a few very small, likely ceremonial issues, and an attempted restoration by Aurelian in AD 270), and the antoninianus became by far and away the predominant coin in use within the Roman empire.[312] The impact of the introduction, withdrawal and re-introduction of the antoninianus will be discussed in the following chapter, but for now we will concern ourselves with the fortunes of the denarius during this terminal period of its history.

In Britain there are four extant hoards ending with coin of this decade, containing a total of 1,727 coins.[313] The earliest of these, the Darfield I hoard (AD 235-238, 481 coins), ends during the reign of Maximinus I when the denarius was the only silver coin in production. The hoard contains only a single antoninianus of Caracalla, with the remainder of the coins being pre-reform (176, 36.6%) and post-reform denarii (304, 63.2%). This is roughly consistent with the proportions seen in the hoards of Severus Alexander, suggesting no major changes to the coinage in circulation in Britain during the reign of Maximinus.

The following three hoards, the smaller deposits from Hartlebury and Standish and the much larger Dereham hoard, end with coin of Gordian III. The first, ending with an issue of AD 241, contains 56 post-reform denarii only. The second, ending with an issue of AD 240-244, contains a single antoninianus (the terminal coin in the hoard), 19 pre-reform denarii (19.4%) and 78 post-reform denarii (79.6%). The final hoard, which ends with an issue of AD 241, contains 16 antoniniani (6 of Caracalla, 3 of Elagabalus and 7 of Gordian III), 107

[311] Bland (1996) 75.
[312] Butcher (2018) 178-179.
[313] Darfield I (*tpq* AD 235-238), Hartlebury (AD 240), Standish (AD 240-244) and Dereham (AD 241).

pre-reform denarii and 969 post-reform denarii for a total of 1,092 coins. The respective proportions of each coin group are 1.47% antoniniani, 9.8% pre-reform denarii and 88.74% post-reform denarii.

The overall impression given by the British hoard evidence is that the rapid decline in the population of pre-reform denarii continued from the reign of Severus Alexander into that of his immediate successors. This would lend credence to our hypothesis of a recall of pre-Severan denarii. As seen with the recall initiated by Domitian, the timescale required for the removal of a large number of denarii from the entirety of the Roman empire is significant (taking almost forty years in Britain, as suggested by the hoard evidence). If a continuing decline in the number of pre-reform denarii can be seen in the coin hoards in the remainder of the empire, then it would seem reasonable to continue our parallel between the two periods.

The hoard dataset for Western Europe during this period encompasses eleven hoards, which contain a total of 7,825 coins. The first six hoards, ending with issues of Maximinus I, are from modern-day Germany and contain 5,025 coins. Of these, the first five (Langengeisling, Niederaschau, Marianfels, Eining 2 and Kastell Zugmantel 1) contain no antoniniani, between 3% and 7.3% pre-reform denarii with the remainder post-reform denarii. The total proportion of pre-reform denarii in these hoards is 3.6%. This dearth of pre-reform issues would indicate a continuing move away from the patterns of more mixed hoards seen under Severus Alexander, and may suggest that the earlier, finer coins were leaving circulation in even larger numbers at this time.

However, the latest of these hoards, the large Köln-Gertrundenstrasse find of 4,011 coins, is very different. 1,373 (34.2%) of these coins are pre-reform denarii, 2,496 (62.3%) are post-reform denarii and 142 (3.54%, 109 of Caracalla and 33 of later emperors) are antoniniani. This is much more typical of the pattern seen in hoards ending under Severus Alexander (with the exception of the increased number of antoniniani) and stands in stark contrast to the evidence of other contemporary Western European finds.

The reason for the apparently unusual composition of the Köln-Gertrudenstrasse hoard is unknown. It is possible that the hoarder was aware of the superior intrinsic value of pre-reform coin and deliberately included as many of them as he or she could get their hands on in the hoard. The hoarder may have been spurred to take action by a coinage recall, in a similar manner to those who preferentially hoarded period 2 denarii of Domitian in Britain during the recall under Hadrian. As discussed above in reference to the Cortanovici and

Francesti hoards, it may be the case that Koln was composed over the course of several decades beginning in a period in which pre-reform denarii were more numerous in circulation. It is also entirely possible that the structure of the Gertrudenstrasse hoard is the product of its transmission, discovery or recording. Of the c.22,500 coins originally found as part of the hoard, only 4,619 could be assigned to the issuing emperor, and of these only 4,011 (less than 18% of the whole find) could by identified by type and included in our dataset. As such, as with any hoard in this study, it is worth treating outliers and their potential implications with an appropriate pinch of salt.

Five Western European hoards end with issues of Gordian III, and again their compositions are mixed and potentially contradictory. The two Italian hoards, the Via Tritone find of 823 coins from Rome and the Stellata hoard of 616 coins from the modern-day province of Ferrata, contain similarly high proportions of pre-reform denarii (11.4 and 10.2% respectively) when compared with their contemporaries. However, the former contains only four Caracallan antoniniani (0.5%), while the latter includes 46 in total (2 of Caracalla, 3 of Elagabalus, 2 of Balbinus and Pupienus and 39 of Gordian III) with the remainder of both hoards being post-reform denarii. It is probable that the Via Tritone hoard, ending with an issue of AD 240, was composed and deposited before the cessation of denarius striking in AD 241, with Stellata coming afterwards.

The other three hoards, two from modern Germany (Kosching 2 and Gunzenhausen) and one from France (Ellignies-Saint-Anne), are more in-keeping with the general pattern seen under Maximinus; a small proportion of pre-reform denarii (between 2.3% and 6.7%), very few antoniniani (3 in the Ellignies hoard and 2 in the Gunzenhausen find) and a preponderance of post-reform issues.

Differences in circulation patterns between Italy and the rest of continental Europe have been identified before, most notably by Richard Duncan-Jones who demonstrated a clear lack of Julio-Claudian coin in Italian hoards when compared with finds from France and Germany.[314] Duncan-Jones suggests that this is a result of the lack of army pay entering the circulation pool in Italy when compared with the rest of the empire, following his thesis that military donatives and public *congiaria* were the main mechanism by which new coinage issues were injected into use. Duncan-Jones' link between circulation patterns and military pay has been refuted elsewhere in this thesis and in other scholarly works, but his

[314] Duncan-Jones (1994) 120-122

underlying evidence is sound. The reign of Gordian III would appear to be another juncture at which Italy differed from the remainder of Europe.

Why might this be the case? The Via Tritone and Stellata hoards would indicate that pre-reform denarii remained in circulation in Italy in larger numbers than elsewhere in the empire at the time, suggesting that the recall of fine silver coin there was less complete. We might expect that Italy, as the home of the mint and the centre of the Roman administration, would see a rapid and efficient removal of coinage during a recall; this can certainly be seen in the hoard evidence dating to the time of the recall under Domitian and his successors.[315] It is possible that Italy, as the most monetised region of the empire, would have a much higher demand for coined money than other areas. If the demand significantly outstripped supply and availability, this would likely force coins which may otherwise be removed from circulation to stay in use. This is purely speculative, and the currently limited availability of reliably published Italian coin hoard evidence means that it is difficult to pin down the nature and cause of these regional variations with any certainty. Hopefully as the recording of coin hoard data continues to improve, this is a point which can be revisited.

Despite these differences, the total proportion of pre-reform denarii in Western European hoards continues to drop under Gordian III to 8.3%. This is much lower than the 27.5% seen in hoards of Maximinus I (including Koln-Gertrudenstrasse) and suggests that the removal of fine silver denarii continued apace.

In contrast to the British hoards, pre-reform issues of Septimius Severus decline significantly in Western Europe from an adjusted proportion of 5.5% under Severus Alexander to 1.8% in hoards of Maximinus I and Gordian III. They are also significantly outnumbered by post-reform issues of the same emperor, which are present at an adjusted proportion of 4.7%. This would appear to contradict our hypothesis that no distinction was made between pre- and post-reform denarii of Severus, and that at least in Western Europe the pre-reform coins were recalled alongside second century issues. However, this ratio is affected by the presence of the large Koln-Gertrudenstrasse hoard, which is of unusual composition as discussed above. When this hoard is removed from consideration the adjusted proportion of pre-reform denarii of Septimius Severus is 3.3%, a much smaller decline. However, given that we now have two potentially contradictory conclusions, we

[315] Murphy (2015) 91-92.

should continue with our regional survey to identify whether either pattern holds elsewhere.

As with Western Europe, there are large numbers of Eastern European hoards in the dataset which end with coins dated to this period. Five hoards end with issues of Maximinus I and again these remain similar in composition to those from the latter stages of Severus Alexander's reign, with a large majority of post-reform denarii (between 66.8% and 92.3%), limited proportions of pre-reform denarii and very few antoniniani (only 8 out of a total of 1,962 coins). The total proportion of pre-reform denarii contained in these hoards is 24.8%, down 19.2% on the hoards of Severus Alexander.

Ten hoards end with issues of Gordian III, containing a total of 2,159 coins. With the exception of two hoards, these finds contain less than 10% pre-reform denarii. The outliers, Taga and Mangalia IV, contain 29.2% and 14% respectively. As with the Koln-Gertrudenstrasse find discussed above, these hoards may represent the last vestiges of preferential hoarding of pre-reform denarii and we must be careful about drawing general inferences from one or two hoards at odds with the majority of finds. However, unlike the Koln hoard, both of these finds are well documented and appear to be largely complete, so perhaps we can put more weight on the evidence provided by them. The Domitianic case study suggested that the removal of coin through recall was less thorough in Eastern Europe than in the West, and it is entirely possible that this trend continued during a recall in the third century.

The total proportion of pre-reform denarii in hoards, including Taga and Mangalia, ending with coin of Gordian III is 21.4%, a very limited decrease on the number seen under Maximinus I and a much higher proportion than seen in contemporaneous Western European finds. If the two outlying hoards are excluded, the proportion is reduced drastically to 4.1%, much more in-keeping with the evidence seen in other regions. This highlights one of the major problems in working with hoard data in aggregate; if one hoard in the dataset (in this case, Taga) is much larger than the others, and its composition is at odds with other contemporaneous finds, it can skew the average away from the general trend. This is not to say that the Taga and Mangalia hoard data is in some way faulty, and indeed they may reflect a difference in the totality of coinage recall on the Eastern frontier as discussed above. However given that the eight other finds of the same date within our dataset present a different picture of the circulation pool, one which can be correlated with

finds from elsewhere, then it is reasonable to assume that Taga and Mangalia are statistical outliers rather than reflections of a general trend.

There are two extant hoards of this period from the Eastern region, specifically from modern-day Turkey. The Sulakyurt hoard of 428 coins, ending with an issue of AD 235-237 under Maximinus I, contains a much lower percentage of pre-reform denarii than its most immediate predecessors at 12.1% (from 89.2% in the hoards ending in the period AD 213-222). However without further hoard evidence for the intervening period, it is impossible to say whether this decline occurred during the reign of Severus Alexander or Maximinus I. Sulakyurt also contains no antoniniani, consistent with the evidence of the previous period and indicative that the coin was not in circulation in significant numbers in the East at this time. Interestingly the Sulakyurt hoard contains a significant number of pre-reform denarii of Septimius Severus, comprising 11.9% of the find. When adjusted for differing issue periods, the pre-reform denarii of Severus actually outnumber his post-reform issues by 31.9% to 20.5%. This continues to lend support to our hypothesis that coin users were unable to distinguish between the pre- and post-reform issues of Septimius Severus, and that they tended to treat them all as been issued on the post-reform standard.

The Yatagan hoard of 243 coins, which ends with an issue of Gordian III dated to AD 243, would indicate that the trend towards removal of pre-reform denarii continues. The hoard is similar in structure to contemporary finds from other regions, containing only 8 pre-reform denarii (3.3%) and no antoniniani. Post-reform issues of Septimius Severus once again outnumber his pre-reform coinage, but only by 6% when adjusted for issue period.

To summarise, during this period we see a continued rapid removal of pre-reform denarii from hoards in all regions of the empire. This ties in with the proposed recall of heavier, finer second century coin from the reign of Severus Alexander onwards. The pre-reform issues of Septimius Severus do not appear to have been withdrawn alongside second century denarii on the same standard in all regions except Western Europe, suggesting that these issues were not targeted. This would indicate that they were not subject to the same difficulties in circulation as the pre-Severan coinage still in use, and that all coins of Septimius Severus was treated as post-reform. This correlates with the imperfect general knowledge of coinage reforms (and subsequent responses to them) that we have seen in earlier periods., and also strengthens our earlier suggestion that without a substantial change in the weight of the denarius the vast majority of the Roman public would be unable to accurately distinguish debased issues from finer ones. The reason for the

contrast between Western Europe and the other regions surveyed is unknown, although it must be noted that if the Koln-Gertrudenstrasse hoard is taken out of consideration then the decline in the proportion of pre-reform Severan denarii is minimal and may simply be reflective of a quirk in the surviving hoard evidence rather than an indicator of regional variation.

Philip the Arab – Aurelian (AD 244 – 275)

Region	Number of hoards	Number of coins	Pre-Severan denarii	Septimius Severus pre-reform	Septimius Severus post-reform	Caracalla denarii	Caracalla antoniniani	Post AD 217 denarii	Post AD 217 antoniniani
Britain	42	86,416	138 (0.2%)	154 (0.2%)	962 (1.1%)	110 (0.1%)	50 (0.1%)	3,097 (3.6%)	81,905 (94.8%)
Western Europe	108	129,313	138 (0.1%)	97 (0.1%)	888 (0.7%)	107 (0.1%)	61 (0%)	3,529 (2.7%)	124,404 (96.2%)
Eastern Europe	68	36,187	1,544 (4.3%)	196 (0.5%)	2,397 (6.6%)	302 (0.8%)	51 (0.1%)	5,669 (15.7%)	26,028 (71.9%)
The East and North Africa	7	4,309	588 (13.6%)	12 (0.3%)	375 (8.7%)	95 (2.2%)	14 (0.3%)	129 (3%)	3,096 (71.8%)
Total	225	256,225	2,408 (0.9%)	459 (0.2%)	4,622 (1.8%)	614 (0.2%)	176 (0.1%)	12,424 (4.8%)	235,433 (91.9%)

Table 14: a summary of hoard evidence from the reigns of Philip the Arab to Aurelian, AD 244-275

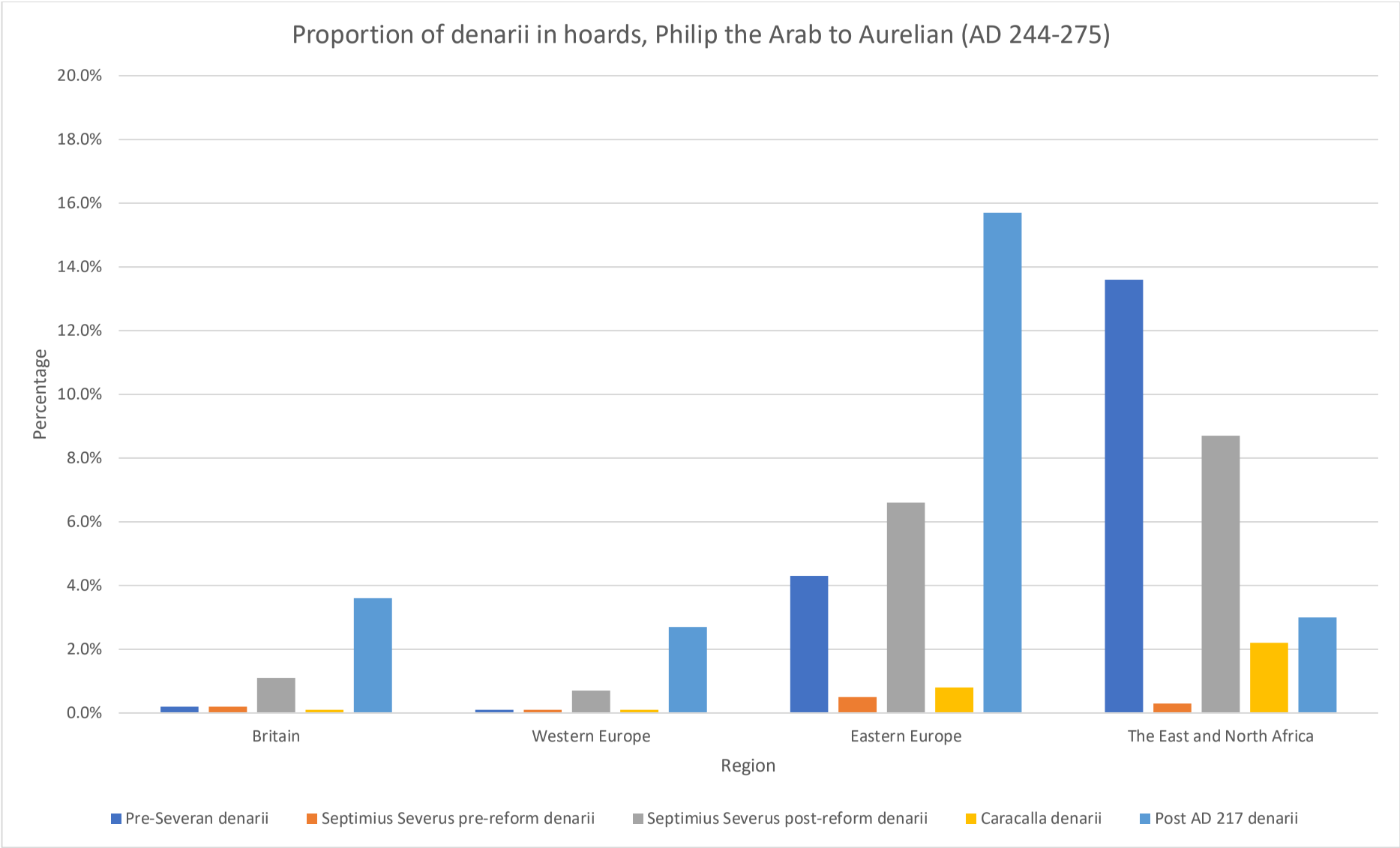


Figure 20: bar chart displaying the data in table 13 (antoniniani omitted and x axis rescaled for clarity).

This period saw the continued accession of a series of 'barracks emperors,' who almost exclusively minted increasingly debased antoniniani as their silver coinage. The social and political upheaval within the empire culminated in the formation of two breakaway states by usurpers (the 'Gallic Empire' under Postumus and his successors and the 'Palmyrene Empire' under Zenobia and Vaballathus) during the reign of Gallienus in what is commonly seen as the high-water mark of the 'Crisis of the Third Century.' The rate of hoarding, both in terms of the quantity and the size of hoards, increases significantly throughout this period. It is this increase which is often cited as representative of the hyperinflation which supposedly overtook the Roman economy around this time, with markets swamped with huge numbers of almost worthless antoniniani struck by emperors and usurpers desperate for funds with which to maintain the loyalty of an increasingly fickle military. As discussed above, this theory is coming under increasing scrutiny in scholarly works. Regardless of the cause and effect, this apparent growth in the prevalence of the practice of hoarding provides us with a wealth of data with which to continue our survey

The British dataset for this period contains a total of 41 extant hoards and 85,601 coins. The major trend throughout this phase is the rapid demise of the denarius, both pre- and post-reform, as a circulating currency. The earliest four hoards, deposited during the reign of Philip the Arab and his usurper/successor Decius in AD 248-251, contain a total of 2.3% pre-reform denarii, down dramatically on the 17.5% seen in hoards of the previous decade. Antoniniani, largely of Gordian III and his successors, become much more common, now making up 23.2% of coins in hoards (up from 1%). The remainder of the hoards (74.5%) consist of post-reform denarii, still circulating in very large numbers.

The following decade, with a single exception, sees the almost complete disappearance of the pre-reform denarius from hoards. Of the 22,780 coins in five hoards, only 23 are pre-reform denarii. The exception to this pattern is the Caister-on-Sea hoard of AD 260, which contains 201 pre-reform denarii out of a total of 847 coins (23.73%). In comparison with the previous decade, post-reform denarii would now also appear to be declining in number with only 1,794 examples recorded (7.6% of total). These results may be skewed by the extremely large Dorchester hoard of 20,748 coins, which contains almost exclusively post-Caracallan antoniniani (20,706 examples). If this hoard is removed from consideration, there is a much less dramatic decline in the proportion of post-reform denarii in hoards from 74.5% to 59.9%. However, a trend of reducing numbers of denarii in circulation can be continue to be discerned following the cessation of denarius striking.

In the final decade of the period under examination, the pre-reform denarius is all but extinct with only 13 examples found in a total of 60,420 coins. Likewise, the post-reform denarius is incredibly rare with 610 finds (less than 1%). These are predominantly (447 denarii) in the four earliest hoards of the period, deposited during the sole reign of Gallienus between AD 263 and AD 269, with sporadic finds in later hoards. The majority of the remainder are in a single find, the Wareham hoard of AD 271, which given the stark contrast with its immediate contemporaries (which only contain antoniniani) must be a product of unusual composition or transmission rather than reflective of the coinage in circulation.

For the same period, the Western European dataset contains a total of 108 hoards and 129,313 coins. The earliest decade mirrors the British finds (if the Dorchester hoard is excluded), with pre-reform denarii becoming increasingly rare (75 examples out of 2,499 coins, 3% of total), post-reform denarii declining as a proportion of hoards (1,337 coins, 53.5% of total) and antoniniani entering circulation in large numbers. This trend continues in hoards of the succeeding decade, with only 0.6% pre-reform denarii, 16.9% post-reform denarii and the remainder as post-Caracallan antoniniani. The final decade under consideration likewise reflects the British evidence, with negligible numbers of denarii and an overwhelming predominance of antoniniani.

The Eastern European hoard dataset contains 68 hoards and 36,187 coins in our concluding period.[316] Interestingly, it is unlike the British and Western European evidence in that the pre-reform denarius appears in significant numbers in several hoards deposited down to the beginning of the reigns of Valerian and Gallienus in AD 253, making up a total of 12.9% of coins found in hoards in the period AD 244-252. Proportions of post-reform denarii and antoniniani in this period are similar to the other two regions at 51.7% and 35.5% respectively. However again the proportion of denarii as a whole in hoards becomes negligible during the reigns of Valerian and Gallienus. Hoards of the period AD 253-262 contain 0.5% pre-reform and 8.8% post-reform denarii (out of a total of 14,359 coins), while hoards deposited during the following decade contain only 0.4% and 1.3% pre- and post-reform denarii respectively. The delay in the final removal of the pre-reform denarius from the Eastern provinces is similar to the one seen during the second century coinage

[316] The vast hoard from Reka Devnia has been omitted from consideration here as the size of the hoard (over 81,000 denarii) would severely distort the average for this period and may not be representative of the general economic position of the Eastern European provinces.

recall, suggesting that whatever the mechanism used to remove coin populations from circulation it was less effective on the Danube frontier.[317]

Finally, the dataset for the East and North Africa contains a total of 7 hoards and 7,306 coins in the period under considerations. All but one of these hoards, which have terminal dates ranging from AD 244-249 to AD 267, contain almost exclusively antoniniani, with only out 11 pre-reform and 335 post-reform denarii of the total of 5,011 coins. This stands in stark contrast to the apparent exclusion of these coins from Eastern hoards in previous decades.

The one exception to this pattern is the Haydere hoard of 2,295 coins from modern-day Turkey. This hoard contains a total of 597 pre-reform (26%) and 502 (21.9%) post-reform denarii, a proportion higher than any other hoard in the entire dataset since the reign of Severus Alexander. This hoard is discussed at length in an article by Roger Bland and Pinar Aydemir, who suggest that significant peaks in the number of coins in the hoard under Septimius Severus and Gordian III indicates that the Haydere hoard may in fact be composed of two deposits; the first of denarii ending during the reign of Elagabalus and the second of predominantly antoniniani deposited under Gallienus. However the authors themselves admit that this is a difficult hypothesis to prove conclusively, largely due to the uncontrolled nature of the hoard's discovery and the lack of integrity of the find (which purportedly originally contained over 5,500 coins).However given the exceptional nature of this hoard when compared to other contemporary evidence, it is likely that it is the product of an unusual composition process rather than reflective of an unusual change in the circulation pool at this time.

To conclude, it is apparent that our proposed coinage recall was successfully completed by the reign of Valerian and Gallienus; with one or two exceptions, the pre-reform denarius was almost completely eliminated from the circulation pool. During the reign of the latter two emperors, there is also a considerable decline in both the discrete number of and the proportion of post-reform denarii in circulation. This has historically been seen as a popular response to the increasing debasement of the antoninianus, seen through the scholarly lens of Gresham's Law. However given our previous case studies it is not unlikely that the ongoing recall of second century denarii was extended to their third century counterparts at this time, as they would have been noticeably more intrinsically valuable than contemporary denarius issues and thus subject to difficulties in circulation. This would

[317] See *supra* 84-87.

explain the rapidity with which the coinage leaves hoards, in the course of less than a decade, and would also provide an explanation for the source of silver used to mint debased antoniniani in such high quantities.

Summary: the denarius in the Third Century AD

At the beginning of the third century the denarius was the predominant silver coin in production and use throughout the Roman world, as it had been for over four centuries. By the end of the period covered by this thesis, the denarius was all but extinct. The hoard evidence examined in this thesis demonstrate that the reforms undertaken by Septimius Severus were the catalyst for this change, the most significant since the restructuring of the base metal denominations by Augustus in 23 BC.

Immediately following the debasement of the denarius in AD 194 hoards continue to be composed of predominantly pre-reform coin for over a decade in Britain and for even longer in other regions of the empire. This is an episode of preferential hoarding of fine silver coin spurred on by the debasement, similar to that seen around the time of the Neronian reforms in AD 64-68. This would suggest that the post-reform denarius of Septimius Severus experienced the same difficulties in circulation as the post-reform coinage of Nero; namely, a bias against the coins in hoard composition and presumably an inferior value against the pre-reform denarius in circulation. These problems would lead to the creation of an unofficial two-tier exchange system and hinder the use of silver coinage in day-to-day exchange, an issue which would need a solution.

It has been suggested by several scholars that this remedy came in the form of the introduction of the antoninianus by Caracalla. This will be discussed in more detail in the following chapter, but for now we can note that the hoard evidence during the reigns of Caracalla and Elagabalus sees a dramatic increase in the number of post-reform denarii deposited alongside pre-reform issues. Given that the number of pre-reform denarii do not appear to diminish alongside the increase in their post-reform counterparts, it is possible that this is evidence that the introduction of the antoninianus was successful in allowing old and new denarii to circulate together. However, production of the antoninianus ended under Elagabalus (the reasons for this will again form part of the next chapter), and a new solution to the two-tier denarius problem needed to be found.

It is suggested here that this solution was a recall of second century denarius issues initiated under Severus Alexander. In much the same way as Domitian ended his attempts to restore the purity of the denarius and instead chose to eliminate fine Republican and

Julio-Claudian coins from circulation, Severus Alexander attempted to end the antoninianus experiment and remove the second century denarius from the equation. The hoard evidence shows a dramatic decline in the number of pre-reform denarii in circulation during this period, and as with the second century recall it is argued that the scope, speed and scale of this shift demonstrates that it was largely as a result of deliberate state intervention rather than natural wastage of coin and the action of Gresham's Law. This recall continued under his successors and, following the re-introduction of the antoninianus, was extended to cover the post-reform denarii still in circulation during the reigns of Valerian and Gallienus. This led to the almost complete disappearance of the denarius, both pre- and post-reform, from hoards and from common use across the empire by around AD 270. The denarius would live on as a notional unit of account used for establishing prices and exchange rates but would never again be minted in significant numbers.

The role of the antoninianus in this narrative is clear; acting both as a restoration of the second century denarius and later as the replacement for the denarius altogether. The rationale behind the introduction of the antoninianus, the chequered history of the coin, the effect which it had on the circulation patterns of the other denominations in circulation and the insight it can provide into the economic and social forces at play in the Third Century AD will be the subject of the next chapter of this thesis.

The Crisis of the Third Century Part 2: The Antoninianus

The production of a large silver coin, approximately one-and-a-half times the size of the contemporary denarius, under Caracalla in AD 215 was the first addition to the Roman denominational system since the Republican period. However the coin, its intended role and its impact remain little understood today, an issue illustrated by the fact that the most commonly used modern name for the coin, the antoninianus, has no ancient authority and is instead based on the full name of the emperor who introduced it. It is indisputable that the antoninianus came into being at a time of significant monetary change in the empire, as demonstrated in the previous chapter, and a better understanding of the denomination would be hugely beneficial to our comprehension of the third century. This has been recognised for several centuries with scholars devoting several major works to this end. This chapter will begin with a review of this historiographical tradition, before contributing to it with an examination of the hoard evidence as in our previous case studies.

Historiography

The earliest works on the metrology of the Roman coinage did not distinguish between the lighter laureate silver coin and its larger radiate counterpart, with both being seen denarii.[318]It was only around the turn of the nineteenth century when scholars began to recognise the heavier coin as a denomination separate from the denarius, with a value superior to it.[319]

Theodore Mommsen was the first to name the newly recognised coin the 'antoninianus,' and was also one of the first scholars to advance the idea that the antoninianus was worth two denarii rather than one and a half. The basis of this theory was that an antoninianus of one and half denarii would have an impractical relationship to the aureus (16.67 antoniniani to the aureus, assuming the continuation of the Augustan system of 25 denarii to the aureus).[320] In Mommsen's opinion, the introduction of the antoninianus was a novel form of debasement intended to increase the fiduciary value of the silver coinage. Mommsen saw this as an inflationary policy which led to rapid price increases, and he compares the introduction of the antoninianus to the inflationary *assignat* currency of 18th century France.[321]

[318] See for example Greaves (1647).
[319] For example in works such as Eckhel (1792) xxvi-xxvii and Pinkerton (1808) 141-142.
[320] Mommsen (1873) 70 and 144.
[321] Mommsen (1873) 147.

At first these arguments were not particularly influential, with scholars such as Hultsch[322] and Hammer[323] regarding them with suspicion. However, Mommsen's narrative was subsequently picked up by scholars in the early 20th century, most notably Harold Mattingly in his 1928 general survey entitled *Roman Coins*,[324] and quickly became part of the orthodox view of the monetary history of the third century AD. Mattingly also argued that, as the imperial bust depicted on the dupondius also featured a radiate crown to signal its double value when compared to the as, a radiate bust was also used by Caracalla and Severus Alexander on their novel large gold denominations to signify their double value.[325] In one form or another, Mommsen's theories have endured to the present day and his work has been greatly influential in the association of the Severan-era reforms with the 'Crisis of the Third Century'.[326]

During the 20th century many scholars (following Mommsen and Mattingly) came to subscribe to the notion that the antoninianus was intended from its inception to function as a double denarius, with its relatively lower weight and therefore silver content acting as an effective debasement of the silver coinage.[327] The radiate crown on the obverse portrait of the emperor (or the crescent on portraits of empresses) denoted a double denomination when compared to laureate portraits. The timing of the creation of the antoninianus, at approximately the same time as Caracalla's increase in military pay, strengthened the notion of the double denarius as if soldiers were paid in new coin then the overvaluation of the antoninianus would allow a pay increase with no corresponding drain on silver supplies. Finally, Cassius Dio's comments on Caracalla's personality seemed to confirm the material evidence:

'He also openly disclosed some of his shameful deeds, as if they were noble and worthy, while others he revealed unintentionally through his efforts to conceal them, as, for example, concerning money.'[328]

---

[322] Hultsch (1862) 321-322.
[323] Hammer (1908) 101.
[324] Mattingly (1928) 124-125.
[325] Mattingly (1928) 121-123.
[326] The 'Third Century Crisis' theory is discussed further above, see *supra* 113-115.
[327] The number of scholars subscribing to this view makes providing a complete list impossible, but for a few examples see Hammond (1946) 78-79, Jones (1974) 194, Crawford (1978) 152-153 and Duncan-Jones (1994) 222.
[328] Cassius Dio, *Historiae Romanae* 78.15.1.

In the minds of the majority of scholars, the accidentally revealed shameful deed referred to is Caracalla's debasement of the silver coinage and the overvaluation of the antoninianus. For many the issue was resolved; one antoninianus was worth two denarii.

An antoninianus tariffed at two denarii whilst only containing one and a half times as much silver bullion would be overvalued in relation to the denarius by 25%. Mommsen and his successors generally see this as an attempt to generate increased profit on the production of silver coinage, driven either by greed or by the need to cover state deficits. If Gresham's Law were applied rigidly to this model the overvalued antoninianus would be expected to drive the undervalued denarius out of circulation, leading to a peak in preferential hoarding of the denarius around AD 215 followed by a decline in their numbers. The movement of large numbers of denarii to regions beyond the frontiers or to areas away from official oversight, where enforcement of legal exchange rates would be more difficult and the bullion content of coins would play a larger role in their valuation, would also result from a two-denarius antoninianus.

However, some scholars continued to reject this convention, although such views remained in the minority. Gunnar Mickwitz stated that, in his opinion, the introduction of the antoninianus served as a restoration of the old, less base denarius issued before the reforms of Septimius Severus. Both coins would contain around 2.3g of silver, the pre-reform denarius due to its superior fineness and the antoninianus by virtue of its improved weight, and as such would have been seen as equal in value.[329] At around the same time, G.C. Haines discussed the position of the antoninianus in the hierarchy of denominations and came to the conclusion that an antoninianus was likely seen as equal in value to the pre-reform denarius, with 25 antoniniani equalling one aureus of 100 grains of pure gold (approximately 6.48g).[330] Louis West and Pierre La Gentilhomme broadly agreed with the assessments of Mickwitz and Haines, questioning how denarii and antoniniani could have circulated together (as hoards containing both denominations would seem to indicate) if the antoninianus was overvalued at two denarii.[331] More recently, Robert Carson[332] and Lawrence Cope[333] have made the claim that the antoninianus was in fact worth less than two denarii.

[329] Mickwitz (1932).
[330] Haines (1941) 28-32.
[331] West (1941) 123-124; La Gentilhomme (1946) 27-28.
[332] Carson (1965) 227-228.
[333] Cope (1969) 145 n.1

This theory's most recent proponent is Kevin Butcher who has refuted several of the 'proofs' offered by Mommsen and his successors.[334] Butcher argues that the radiate crown could be used to indicate a different denomination in the same metal, but not necessarily a double denomination. As evidence, he discusses the radiate gold coins of Trebonianus Gallus, which did not weigh twice as much as contemporary laureate aurei, as well as Syrian tetradrachms which can be found with both laureate and radiate portraits. Butcher also repeats that the antoninianus *was* hoarded alongside denarii and that the supposed 'simplicity' of a double denomination is of dubious quality as evidence.

Butcher ties the introduction of the antoninianus to a contemporary revaluation of denarii issued prior to the Severan debasement of AD 194 which were still in circulation in large numbers. Butcher suggests that the antoninianus was designed to contain as much silver bullion as a pre-AD 194 denarius, and that both were retariffed to circulate at a premium of 50% over contemporary post-reform denarii. This move was in order to legitimise the unofficial premium which had been placed on pre-reform denarii since the debasement, and thereby to ease problems in the exchange and circulation of silver coins. If military payments were made in post-reform denarii, larger numbers of coins could be paid to troops with no corresponding increase in precious metal expenditure by the state.

If we were to accept this position, it has a major bearing on how we view the rationale behind the introduction of the antoninianus. Rather than intending to debase the coinage to increase state revenue, Caracalla may instead have been attempting to continue production of silver coins containing the same weight of precious metal as the heavy and fine pre-Severan reform denarii issued prior to AD 194. This has echoes of the restoration of the pre-reform Julio-Claudian/Republican denarius by Domitian in AD 82/85 following the reforms of Nero in AD 64-68 and may indicate that a similar series of events was taking place. Like Domitian, Caracalla may have been reacting to economic problems caused by the reform, and his solution was to attempt to restore the old standards.

An analysis of coin hoarding patterns may help to determine whether this suggestion carries any merit, as an antoninianus worth one and a half denarii and containing the equivalent in silver would circulate at parity with the denarius. This would suggest that both coins should be hoarded without preference, as they each represent separate denominations and neither is over- or undervalued in relation to the other. In turn, this

[334] Butcher n.d. *passim* (unpublished conference paper, a draft of which has been kindly provided by Professor Butcher.)

could help to shed light on the reasons behind the production of the antoninianus and its place in the Roman monetary system. Admittedly this reading is complicated by the fact that, unlike Domitian, Caracalla continued to mint denarii on the post-reform standard alongside his antoniniani, and his successors alternated between producing antoniniani and post-reform denarii. The reason for this is currently unknown, but it is often surmised that the antoninianus somehow proved unpopular with the Roman public for unknown reasons. Presumably the populace identified it as overvalued against the denarius and rejected it.[335] However if the antoninianus was instead tariffed at 1.5 denarii and thus were not overvalued then a new interpretation for the oscillation between denarius and antoninianus production in the years 215-222 must be sought.

A third model for the valuation of the antoninianus, a combination of the two hypotheses discussed above, was advanced by Roger Bland in his paper 'The development of gold and silver denominations, AD 193-253.' In this important work Bland argues that Caracalla introduced the antoninianus as a cost-cutting measure, chiefly in response to his increase in military pay, and as such overvalued it significantly by setting its legal value at 2 denarii. However this overvaluation was immediately apparent due to the antoninianus' reduced weight, and as such the denomination was not popular both amongst the public who discriminated against it in hoards and amongst Caracalla's successors who all abandoned production of it in favour of the denarius at some point during their respective reigns. Gordian III, when attempting to settle the currency on the antoninianus, recognised this problem and retariffed the coin per its weight (i.e. at one and a half denarii), enabling it to become much more successful and increasing the proportion of the denomination found in hoards after AD 240

This model envisages an overvalued antoninianus from AD 215-240, with parity from AD 240 onwards. In these circumstances, Gresham's Law would indicate that the antoninianus should drive the denarius out of circulation from AD 215, as in model one. The subsequent retariffing of the antoninianus in AD 240 would then prevent this effect by eliminating its overvaluation, as in model two.

The debate over the position of the antoninianus reflects on a wider dispute in ancient numismatics on the valuation of coinage. This debate has been discussed in more detail in the initial literature review but to recap, modern currency has an extremely low intrinsic value and instead derives its worth ultimately from the fiat placed on it by issuing

[335] Bland (1996) 76-79.

authorities. This almost complete reliance on state fiat is a relatively recent innovation however, only coming about in the mid to late twentieth century AD. Prior to this, the majority of circulating money used in Europe derived all or part of its value from its intrinsic worth as a commodity.[336] These two financial systems, fiat money and commodity money, were formally labelled as 'chartalism' and 'metallism' respectively by Georg Friedrich Knapp in 1905, and they have alternately competed with and complemented one another in currency systems for millennia.

The use of both metallist and chartalist approaches can be seen at various times during the Roman imperial period. The use of base metal currencies in place of fractional silver denominations is inherently chartalist. The position of *aes* denominations in the monetary system greatly overvalues them in relation to silver and gold in terms of their precious metal content, indicating that they derived a majority of their value from state fiat and circulated as an effectively token currency on the basis of public trust and the overwhelming need for small change. At the opposite end of the scale, the valuation of the Roman gold coinage appears to have been predominantly metallist. Despite occasional changes to its weight, the aureus and its successors, the solidus and the nomisma appear to have been consistently struck in pure gold since its introduction as a regular coin under Julius Caesar until the early eleventh century.[337] Diocletian's infamous *Edict on Maximum Prices* makes no distinction between the value of coined gold, gold bullion, gold jewellery or spun gold, which are all valued at 72,000 *denarii communes* per pound.[338]

Which system of valuation was prevalent during the Roman period is of great relevance when discussing currency debasements and reform. If a metallist system was employed, the effect of changes to the composition of metal currency would be expected to have huge economic and monetary impact. Conversely a chartalist approach would minimise the role of debasement in currency circulation, with points of change being seen instead at times of changes to the denominational system (such as the introduction of new currency units such as the antoninianus or the retariffing of existing coinage.) It is probable that the

[336] There are some exceptions, such as the paper money issued in France by John Law and the Banque Générale in 1716 and the assignats of the later 18th Century which were both partially backed by the French government rather than by gold or silver. Fiat paper money was also common in China from the 7th century AD onwards.
[337] There is evidence of debasement of the aureus under Valerian and Gallienus, with purity declining from around 98-99% to as low as 65.6%; this may be connected to the introduction of a new gold denomination, the solidus. The fineness of the aureus was rapidly restored under Gallienus' successors; Bland (1996) 73.
[338] Per the translation in Kropff (2016).

truth lies somewhere between these two extremes, with the prevailing attitude towards the currency affected by factors such as the general economic background, geographical location and the socio-economic position of the individual coin user. Once again, study of coin hoards and their composition will be invaluable in shedding further light on this topic.

Metrology, metallurgy and production history

The antoninianus, like other denominations during the third century, underwent significant material changes during its production life. When first produced under Caracalla in AD 215, the coins were struck using a similar alloy to the denarius (containing around 46% silver) and a target weight standard of around 5.1g per coin, half again as much as the contemporary denarius. As such freshly minted examples of the antoninianus struck under Caracalla contained approximately 2.35g of silver each, similar to the pre-reform denarii which still made up the bulk of circulating silver specie. Caracalla's successors, Macrinus and Elagabalus, also struck limited issues of antoniniani on a comparable standard, before production of the coinage ended altogether in AD 219.

As noted in the previous chapter, the reign of Severus Alexander is seen as a major watershed in the political, social and economic history of the empire. Alexander was the last of the Severan dynasty, with his successor Maximinus I being the first of the so-called 'barracks emperors.' Alexander continued the hiatus on minting the antoninianus and struck only denarii during his 13-year reign. Historians have often taken this as a signal that the Caracallan-standard antoninianus had 'failed,' its overvaluation having been immediately recognised by the coin-using public who consequently refused to use it. A lack of antoniniani in hoards has been used to support this hypothesis, a theory we will re-examine in this analysis.

Balbinus and Pupienus reintroduced the antoninianus during their short reign of a few months in AD 238. The fineness of the coin remained the same as the Caracallan standard antoninianus, although the average weight of newly struck antoniniani was reduced to around 4.5g. This mirrored a similar decline in the weight of contemporary denarii, which weighed on average 3.1g when issued, and appears to have been intended to maintain the approximate 1:1.5 silver ratio between the two denominations. The decreasing weight of the silver coinage in general may be indicative of the continuing difficulty in the production of silver coinage which spurred the initial Severan debasement, as discussed above.

The reason for the reintroduction of the antoninianus at this time remains a point of contention. As with the majority of scholarship on the antoninianus it is often seen as a

‘debasement by stealth,’ with the need for coinage to rebuild after a civil war and to pay off the troops still loyal to Maximinus I trumping the desire to maintain a strong and stable currency. However as noted above, the debasement narrative is no longer entirely satisfactory. It is possible that Balbinus and Pupienus intended to replace the denarius entirely with the antoninianus, although this seems unlikely given the seeming attempt to maintain the precious metal relationship between the denarius and the antoninianus. In any case, the extremely short reign of the two co-emperors makes it difficult to determine what their long-term plans for the silver coinage were.

What is clear is that under their successor Gordian III denarii were discontinued in general production (with the exception of one large series struck in c.AD 240 and several very small and sporadic issues in the following decades) and the antoninianus became the sole silver coin produced by the Roman mint. As noted in the previous case study, the denarius does not appear to have been removed from circulation immediately. However, it does diminish as a proportion of hoards deposited in most regions of the empire for the following decade before declining rapidly during the joint reign of Valerian and Gallienus. It is possible that this represents an extension of the ongoing recall of pre-reform denarii to their post-reform counterparts, in an attempt to remove the denarius from the circulation pool in its entirety to be replaced with the antoninianus. In this case, the reintroduction of the antoninianus would be the third century equivalent of the AD 85 reform under Domitian or the Trajanic return to the First Neronian standard in AD 100: the less intrinsically valuable coin returns to production and the older, heavier and more valuable issues in circulation are removed to iron out difficulties in exchange.

From its reintroduction in AD 238 onwards the antoninianus was repeatedly reduced in size and fineness, with most emperors tinkering with the composition of the coin. Under Gordian III the coin was slightly smaller than the Caracallan antoninianus at 4.5g and 42% silver (1.9g of silver content total). By the reign of Aurelian the antoninianus weighed on average 2.5g and had a silver content of approximately 2.5% (0.06g), most of which was found in the artificially enriched layer on the surface of the coin. As with all metrological and metallurgical data available for this period we are largely reliant on the work of David Walker, which as noted above has been found to be insufficient.

Methodology

It is evident from the brief review given above that scholars remain deeply divided on the antoninianus, and that several key questions remain:

- What was the rationale behind the introduction of the antoninianus in AD 215?
- Why was the denomination repeatedly discontinued and reintroduced in the years AD 215-219?
- Did the alternation between denarius and antoninianus production in the years AD 215- 240 impact on circulation patterns?
- Why was the denarius replaced with the antoninianus under Gordian III?
- Can the introduction of the antoninianus over the course of the third century be said to link to a wider 'Crisis' throughout the empire?

A broad spectrum of positions have been held on each of these questions by scholars, who commonly use hoard evidence as 'proof' of their respective viewpoints. Hoards and their contents are often viewed through the theoretical lens of Gresham's Law, which as discussed in previous chapters is a flawed approach which often leads to misuse of the extant data. As such, this case study will begin with a discussion of Gresham's Law in the context of the antoninianus and an outline for an alternative approach which may help to mitigate some of the issues identifies. A survey of the hoard evidence using the dataset detailed in the previous chapter will be conducted in chronological order, as in the previous case studies. Finally, a review of the above questions in light of the findings of the hoard survey will conclude the case study.

For the purposes of this thesis we will restrict our survey to the circulation of the better-studied antoniniani of Caracalla, Macrinus and Elagabalus, as sufficiently robust metrological and metallurgical data for latter antoniniani is not yet available. However, we await the results of the surveys of Butcher and Ponting with optimism and suggest that a review of the later coinage considering their findings would be a beneficial avenue of new research.

Ruler	Average silver content of antoninianus	Average weight of antoninianus (g)	Average weight of silver per antoninianus (g)
Caracalla (AD 215-217)	46%	5.2	2.39
Macrinus (AD 217)	50%	5.2	2.6
Elagabalus (AD 218-219)	46%	5.2	2.39
Balbinus and Pupienus	42%	4.5	1.89
Gordian III (AD 238-244)	42%	4.5	1.89

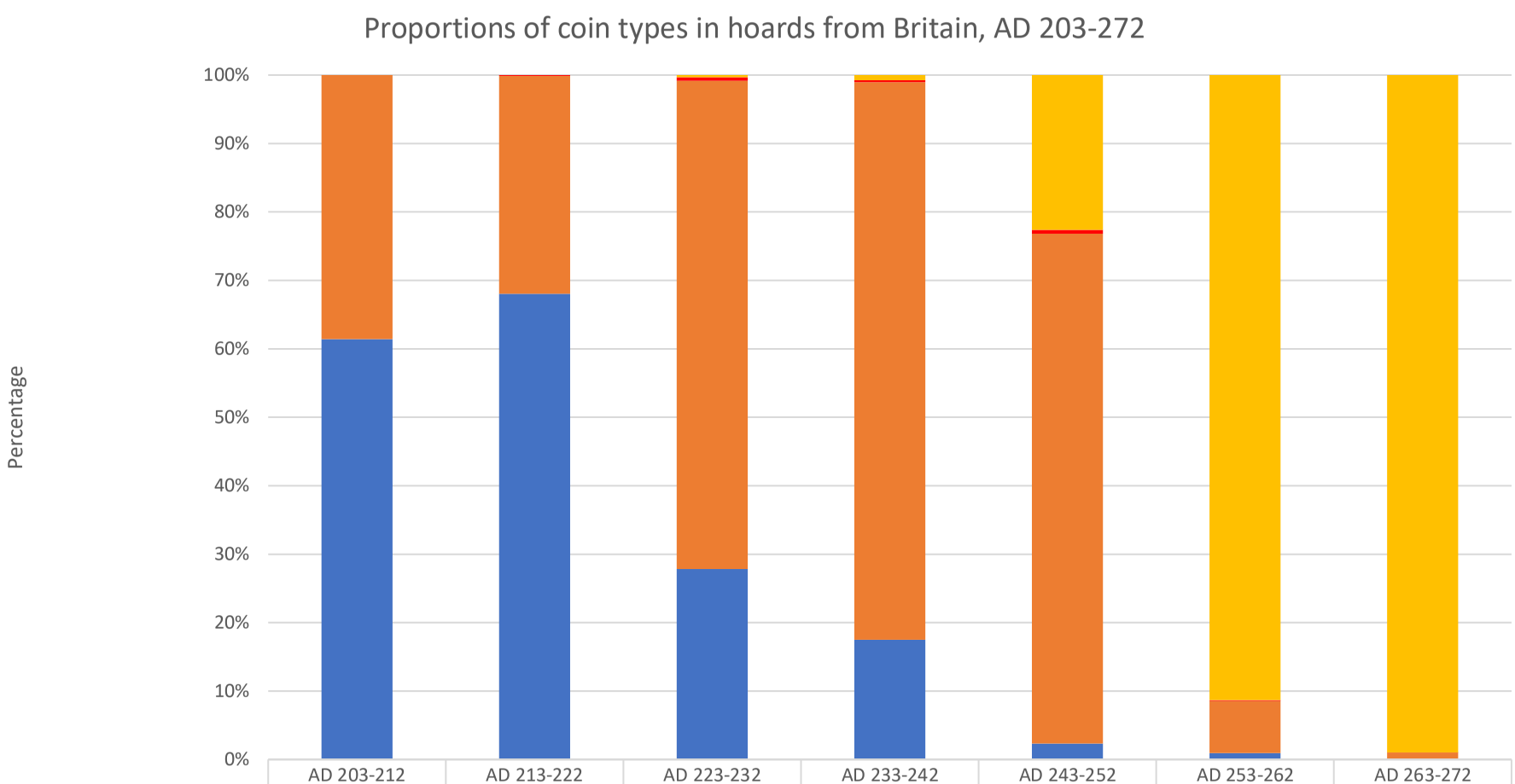
Table 15: metrological and metallurgical standards of antoniniani issued AD 215-244. Fineness figures are the same as that of the contemporary denarius, as the same alloy was used. Weight figures taken from Bland (2012). Figure for Macrinus reflects a potential slight improvement in fineness noted in Walker (1978)*, although this must be treated with caution*

Summary tables and graphs

Britain

Decade	Number of hoards	Pre-reform denarii		Post-reform denarii		Caracallan antoniniani		Post-Caracallan antoniniani		Total
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage	
AD 203-212	9	1969	61.44	1236	38.56	0	0.00	0	0.00	3205
AD 213-222	4	524	68.05	245	31.82	1	0.13	0	0.00	770
AD 223-232	4	3694	27.84	9465	71.33	66	0.50	44	0.33	13269
AD 233-242	4	302	17.49	1407	81.47	5	0.29	13	0.75	1727
AD 243-252	4	55	2.32	1765	74.50	13	0.55	536	22.63	2369
AD 253-262	6	224	0.95	1794	7.59	33	0.14	21576	91.32	23627
AD 263-272	31	13	0.02	610	1.01	4	0.01	59793	98.96	60420

Table 16: summary of hoard evidence recorded from Britain, AD 203-272. Percentages are simple proportions.



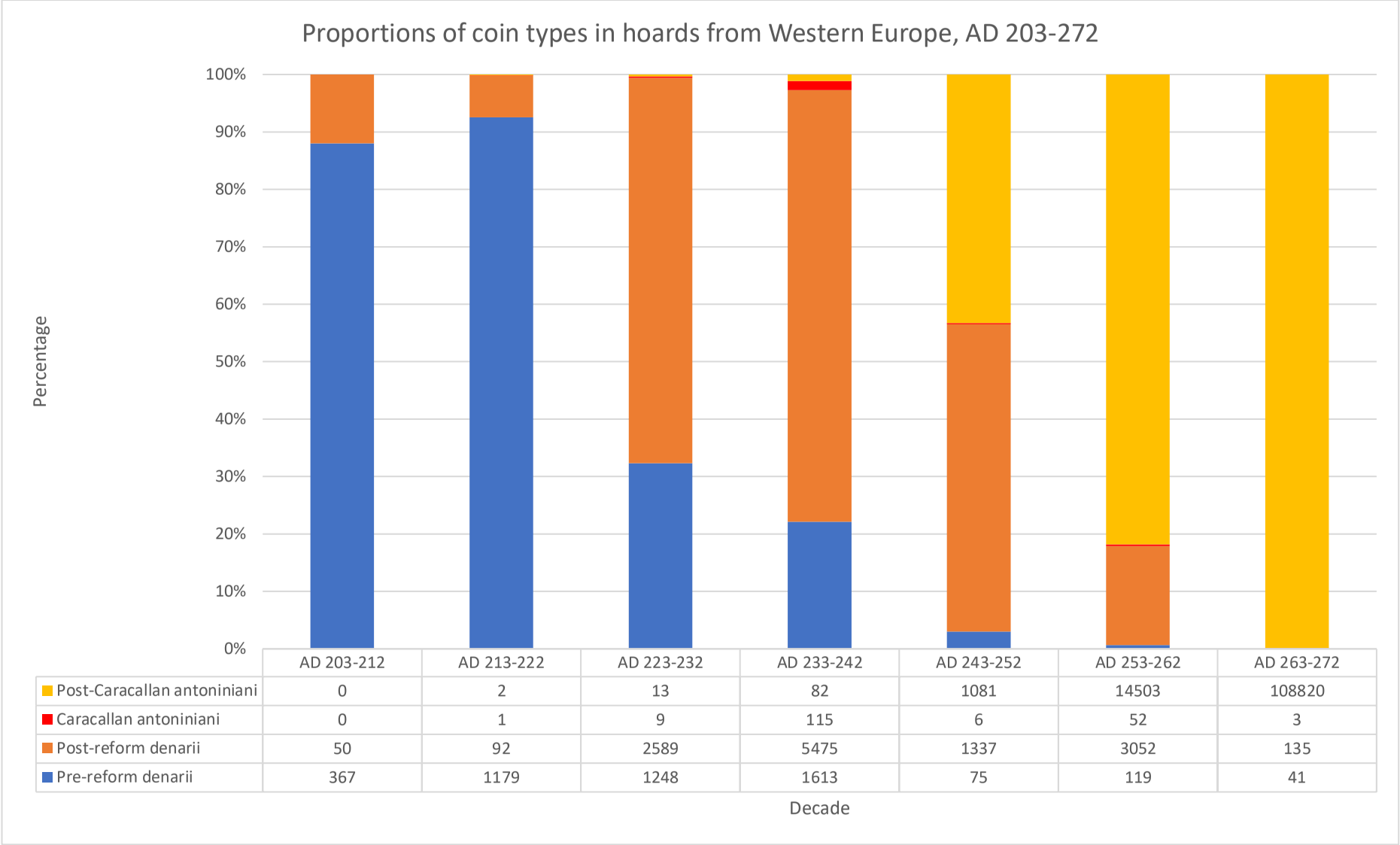
	AD 203-212	AD 213-222	AD 223-232	AD 233-242	AD 243-252	AD 253-262	AD 263-272
Post-Caracallan antoniniani	0	0	44	13	536	21576	59793
Caracallan antoniniani	0	1	66	5	13	33	4
Post-reform denarii	1236	245	9465	1407	1765	1794	610
Pre reform denarii	1969	524	3694	302	55	224	13

Figure 21: 100% stacked bar chart displaying the data in table 15.

Western Europe

Decade	Number of hoards	Pre-reform denarii		Post-reform denarii		Caracallan antoniniani		Post-Caracallan antoniniani		Total
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage	
AD 203-212	3	367	88.01	50	11.99	0	0.00	0	0.00	417
AD 213-222	5	1179	92.54	92	7.22	1	0.08	2	0.16	1274
AD 223-232	14	1248	32.34	2589	67.09	9	0.23	13	0.34	3859
AD 233-242	11	1613	22.14	5475	75.15	115	1.58	82	1.13	7285
AD 243-252	15	75	3.00	1337	53.50	6	0.24	1081	43.26	2499
AD 253-262	30	119	0.67	3052	17.22	52	0.29	14503	81.82	17726
AD 263-272	63	41	0.04	135	0.12	3	0.00	108820	99.84	108999

Table 17: summary of hoard evidence recorded from Western Europe, AD 203-272. Percentages are simple proportions.



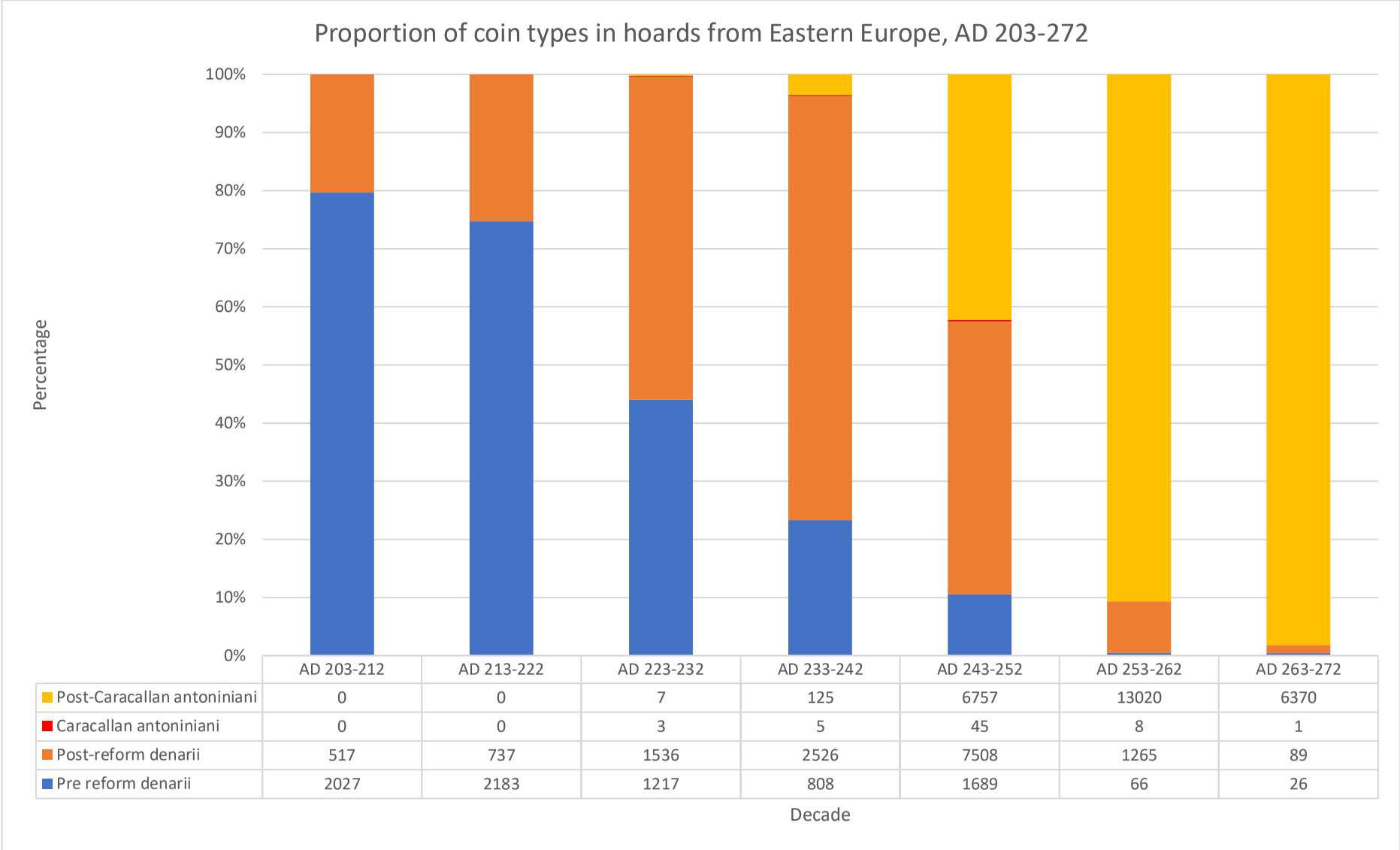
	AD 203-212	AD 213-222	AD 223-232	AD 233-242	AD 243-252	AD 253-262	AD 263-272
Post-Caracallan antoniniani	0	2	13	82	1081	14503	108820
Caracallan antoniniani	0	1	9	115	6	52	3
Post-reform denarii	50	92	2589	5475	1337	3052	135
Pre-reform denarii	367	1179	1248	1613	75	119	41

Figure 22: 100% stacked bar chart displaying the data in table 16.

Eastern Europe

Decade	Number of hoards	Pre-reform denarii		Post-reform denarii		Caracallan antoniniani		Post-Caracallan antoniniani		Total
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage	
AD 203-212	3	2027	79.68	517	20.32	0	0.00	0	0.00	2544
AD 213-222	6	2183	74.76	737	25.24	0	0.00	0	0.00	2920
AD 223-232	6	1217	44.05	1536	55.59	3	0.11	7	0.25	2763
AD 233-242	11	808	23.33	2526	72.92	5	0.14	125	3.61	3464
AD 243-252	33	1689	10.56	7508	46.93	45	0.28	6757	42.23	15999
AD 253-262	30	66	0.46	1265	8.81	8	0.06	13020	90.67	14359
AD 263-272	9	26	0.40	89	1.37	1	0.02	6370	98.21	6486

Table 18: summary of hoard evidence recorded from Britain, AD 203-272. Percentages are simple proportions.



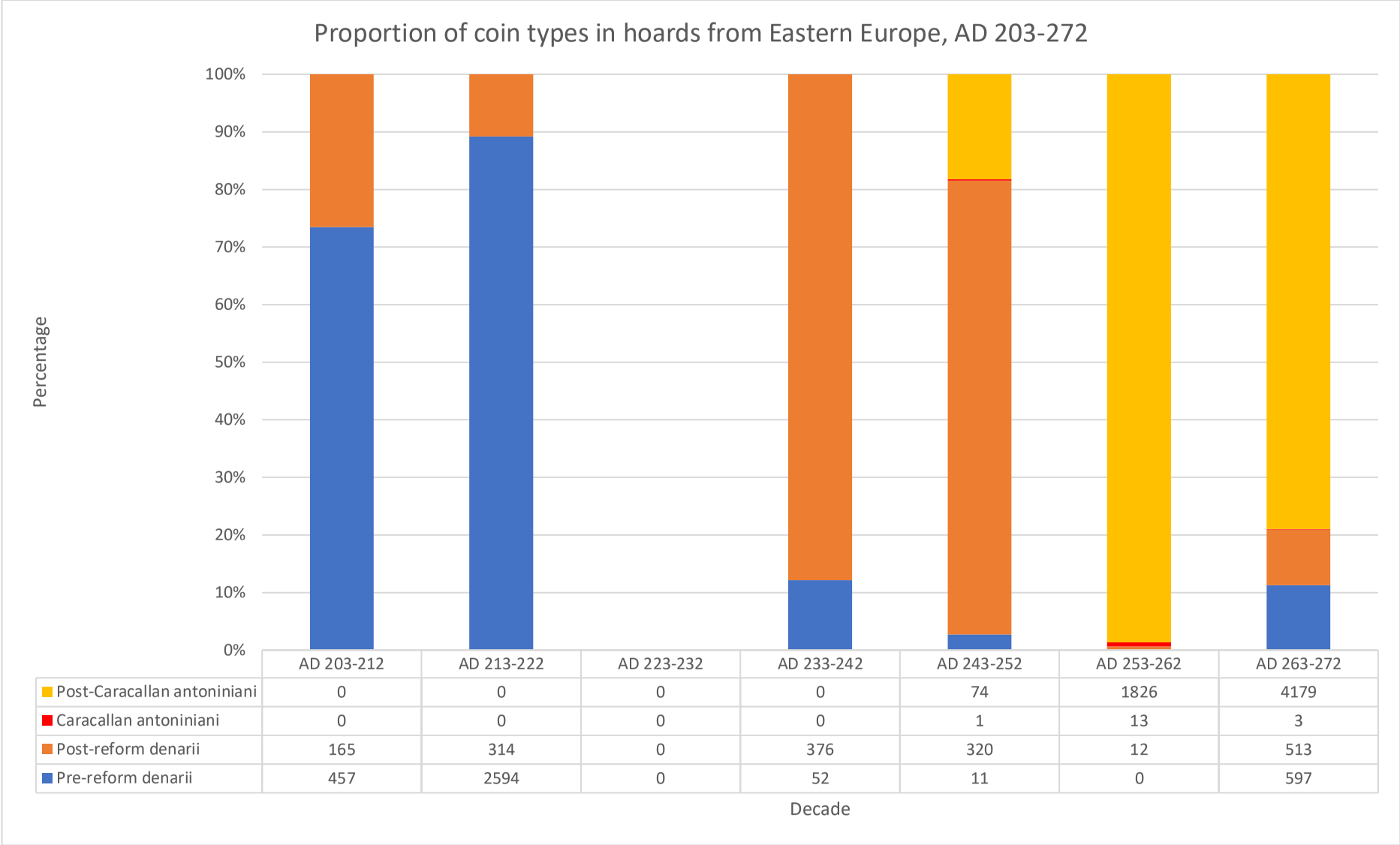
	AD 203-212	AD 213-222	AD 223-232	AD 233-242	AD 243-252	AD 253-262	AD 263-272
Post-Caracallan antoniniani	0	0	7	125	6757	13020	6370
Caracallan antoniniani	0	0	3	5	45	8	1
Post-reform denarii	517	737	1536	2526	7508	1265	89
Pre reform denarii	2027	2183	1217	808	1689	66	26

Figure 23: 100% stacked bar chart displaying the data in table 17.

The East and North Africa

Decade	Number of hoards	Pre-reform denarii		Post-reform denarii		Caracallan antoniniani		Post-Caracallan antoniniani		Total
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage	
AD 203-212	2	457	73.47	165	26.53	0	0.00	0	0.00	622
AD 213-222	5	2594	89.20	314	10.80	0	0.00	0	0.00	2908
AD 223-232	0	-	-	-	-	-	-	-	-	-
AD 233-242	1	52	12.15	376	87.85	0	0.00	0	0.00	428
AD 243-252	3	11	2.71	320	78.82	1	0.25	74	18.23	406
AD 253-262	3	0	0.00	12	0.65	13	0.70	1826	98.65	1851
AD 263-272	2	597	11.28	513	9.69	3	0.06	4179	78.97	5292

Table 19: summary of hoard evidence recorded from Britain, AD 203-272. Percentages are simple proportions.



	AD 203-212	AD 213-222	AD 223-232	AD 233-242	AD 243-252	AD 253-262	AD 263-272
Post-Caracallan antoniniani	0	0	0	0	74	1826	4179
Caracallan antoniniani	0	0	0	0	1	13	3
Post-reform denarii	165	314	0	376	320	12	513
Pre-reform denarii	457	2594	0	52	11	0	597

Figure 24: 100% stacked bar chart displaying the data in table 18.

Caracalla to Maximinus I (AD 211-AD 238)

This period encompasses the introduction of the antoninianus under Caracalla, continuing production on a similar standard during the reigns of Macrinus and Elagabalus until the cessation of antoninianus minting under the latter, and finally the reigns of two emperors who struck only denarii. The antoniniani struck during the period were generally produced using the same alloy as the contemporary denarius (46% silver) and an approximate target weight of 5.1g per coin, leading to a silver content of around 2.35g. Antoniniani struck to these specifications will be referred to as 'Caracallan standard' throughout.

Gresham's Law and the antoninianus

The fundamental problem with the study of the antoninianus is our lack of understanding of its role within the denominational system. The most popular position, following Mommsen and Mattingly, is that the antoninianus was worth twice as much as the contemporary denarius despite only containing one and a half times as much precious metal. Scholars claiming the antoninianus was worth two denarii under Caracalla cite the relative scarcity of these coins in hoards of the early third century, indicating that the coins were identified as overvalued and therefore were 'unpopular.' The alternative perspective is that the antoninianus was worth one and a half denarii, in line with its relative silver content. Proponents of this view argue that the concurrent hoarding of antoniniani and denarii proves that the antoninianus could not have been overvalued as it would have driven the undervalued denarius out of circulation.

Both sides of the debate have used hoard studies in support of their position, relying on differing interpretations of Gresham's Law. However as seen above this is fraught with difficulty. Using Gresham's Law as a strict predictor of economic behaviour is nigh impossible due to the complex factors at play in monetary behaviour. For example, to determine the extent of the over- or undervaluation of precious metal denominations we first need to know the relative value of the bullion which they contain. However market values of bullion were (and are) subject to such a huge variety of influencing factors that they would likely have varied substantially over space and time, and as such it is incredibly difficult to approach a single model which would apply to the entirety of the Empire. In turn, bullion valuation is but a single facet in the application of Gresham's Law and other aspects can prove equally convoluted.

The real value of Gresham's Law lies not in its ability to predict the outcomes of monetary change, but as a diagnostic benchmark by which we can compare and contrast the picture

delivered by the evidence. This is the approach recently adopted by Colin Elliot in an unpublished paper discussing the Severan reforms. In short, Elliott describes three counterfactual scenarios which could have occurred following the debasement of the denarius in AD194; overvaluation of the denarius against the aureus, undervaluation of the denarius against the aureus or parity between the silver and gold coinages. He outlines the expected outcomes of each scenario were Gresham's Law to function perfectly, providing three 'ideal' cases to compare with the surviving evidence in order to identify points of difference and to enable discussion of potential causes and effects.

This approach will be trialled here, however, a major complication exists in the case of the antoninianus that was not present in Elliot's analysis. The recent Severan debasement and the introduction of the post-reform denarius means that not one but two distinct *de facto* silver standards were already in circulation in AD 215. Caracalla also seems to have introduced a 'radiate aureus,' weighing twice as much as the laureate version, at the same time. This creates a complex, multi-layered picture of changes to the coinage, and makes the construction of counterfactual histories much more difficult. The introduction of two evidently new denominations in the form of the antoninianus and the radiate aureus was a first for the central Roman coinage since the reign of Augustus, and it throws open the possibility that Caracalla may have even adjusted the system of denominations relationships that was created under that emperor. We should begin by trying to establish the basis on which our scenarios will be created, and to identify the most probable scenarios to test.

In brief, four major variables may have affected the impact of the Caracallan reforms. These are:

- The value of the antoninianus – based on its metallic value of one-and-a-half times that of a denarius, or a 'face value' of higher than 1.5 denarii?
- The system of denominations in use at the time – the Augustan system of 25 silver denarii to the aureus, or a new system?
- The relative value of gold to silver, and of coinage to bullion.
- The role of the pre-Severan reform denarii still in circulation – did the pre-reform denarius continue to function as a denarius, or was it assimilated to the antoninianus?

Each of these four variables has multiple potential outcomes, creating a large number of prospective counterfactual scenarios to explore. It would be unnecessarily long-winded and

repetitive to discuss each of these in turn, particularly as several possibilities will lead to similar results. A more efficient approach would be to discuss each of these variables in turn, identify any possibilities which can be dismissed *ab initio* on the grounds of probability and determine which circumstances it would be valuable to examine in more detail.

The value of the antoninianus

The antoninianus was and is self-evidently a new denomination (despite the conceptions of early scholars such as Greaves, who saw the coin as a 'heavy denarius')[339] ; it is plainly larger and of a different obverse design to the Caracallan denarius (the reverse types were generally the same). This would have been immediately obvious to the coin-using Roman public. As discussed above, previous scholarship has taken the stance that the coin was shoehorned into the existing system as a double-denarius and was thus overvalued in relation to the other precious metal currencies in circulation.

The issue with this is that this line of argument is largely based on stylistic (the radiate crown), comparative (links to the introduction of the radiate 'double aureus), circumstantial (increases in the rate of military pay) and moral (currency reform as 'decline') considerations. Despite repeated assertions that the overvalued antoninianus would have been unable to circulate effectively alongside the undervalued denarius, little effort has been devoted to a systematic study of the extant coin hoard evidence to determine the extent to which this is accurate (if at all).

As discussed in the previous case studies, the Roman coin using public was able to detect devaluation of the precious metal currency and act accordingly. It seems likely that manipulation of the weight of the coinage in this case, rather than the approach of modifying the purity of the alloy used as seen in earlier debasements, would exacerbate this effect as it would be much easier to detect. Rather than requiring complex assay equipment or inside knowledge of mint procedures, anyone with a reasonably accurate pair of scales could see that the antoninianus did not weigh the same as two denarii. Such a disconnect between the intrinsic value of the coin (which was of significant concern to the Roman public, as seen in previous chapters) and the 'face' value with which it was intended to circulate would almost certainly cause intractable issues in its circulatory life.

[339] Greaves (1647)

As discussed in the historiographic review above, several scholars have recognised this issue and suggested that it is much more likely that the antoninianus was intended to act as a coin worth 1.5 times the denarius struck under Caracalla.[340] The potential rationale for this change is discussed in the following section, but if we accept this alternate theory as to the value of the antoninianus then there are significant implications for the denomination's potential effect on the Roman economy. Rather than being overvalued, the antoninianus should have been able to command the trust of the metallist-leaning Roman public, and as such should have circulated effectively. The relationship between the antoninianus and other denominations would also have been impacted.

Of the two alternatives, I find the second position to be the most persuasive *prima facie*. Rather than appealing to iconographic and circumstantial interpretation, all of which are subject to a significant degree of confirmation bias on the part of the scholar constructing the narrative, this argument is grounded in the extant material evidence. However, this is not to say that such a position should be adopted without caution or due consideration of the alternatives. As such it would be valuable to construct counterfactual histories of both potential scenarios, to allow further contrast with the available hoard evidence.

Pre-Severan reform denarii

The second variable to take into account is the role of the large number of pre-Severan reform denarii still in circulation during the reign of Caracalla. Scholarship on the subject has traditionally assumed that the pre-reform denarius continued to be officially valued at the same rate as the post-reform denarius under Caracalla. As a result, the mostly heavier and purer pre-reform denarii would have been drastically undervalued when compared to their post-reform counterparts. As we saw in the review of hoards ending under Septimius Severus, this valuation appears to have caused major issues with the circulation of pre-reform coinage. This parallels the issues around the Republican denarius following the reforms of Nero; the coins remained in circulation in large numbers and were integral to the monetary supply within the empire, but they were unable to circulate effectively as they were essentially traded at a premium when compared to the newer, less intrinsically valuable issues. Gresham's Law should also have operated where Elliot's three preconditions were met, and this would have further increased the strain on the monetary system as specie moved out of circulation and the money supply fell behind demand.

[340] Butcher (2018) 178, building on the work of earlier scholars such as Mickwitz (1932), Haines (1941) and La Gentilhomme (1946).

Butcher's re-evaluation of the value of the antoninianus offers an alternative view. Given that their silver content is almost identical to that of the antoninianus, it is possible that the pre-reform denarius and the antoninianus would be treated as equivalent, particularly if coin users were sensitive to the metallic content of their precious metal currency. These two coins would have circulated at a higher value than the post-reform denarius, enabling all three denominations to have worked alongside one another within the monetary economy. Why Caracalla would have chosen to develop a new denomination to act as a 'restoration' of the older denarius, rather than simply returning to the production of pre-reform standard coin as Domitian had done, is unknown. Perhaps he was concerned about the impact on the economy caused by changes to the circulation patterns of the numerous post-reform denarii in circulation if this denomination was suspended, so decided to continue producing both coins?

The effect of enabling the efficient circulation of the large number of pre-Severan denarii still in existence alongside their post-reform counterparts is indicative of the rationale for the introduction of the antoninianus, per Butcher. Caracalla had been left a similar issue by the Severan reforms as Domitian had by the Neronian; the effective circulation of two denarius standards at par was impossible. The initial response in both cases was to 'reboot' the system to a working configuration by restoring the standards of the old currency. However, rather than do away with production of the post-Severan reform denarius entirely as Domitian had done with those of Nero, Caracalla instead issued a new denomination corresponding to the older, more valuable denarii still in circulation. Henceforth the silver coins would circulate at a value which reflected their relative precious metal content, with pre-reform denarii and antoniniani alike being valued one-and-a-half times greater that the post-reform issues.

Given the issues identified in the circulation of pre-reform coins in the hoard evidence for the reign of Septimius Severus, the assimilation of pre-reform denarii and antoniniani offers an attractive solution. Certainly it was not beyond the ken of Roman monetary administrators to come up with such a remedy for economic difficulty, as seen in the aftermath of the Neronian reforms. Given the Roman populace's sensitivity to changes in the composition of the coinage, the successful circulation of two coins of effectively identical intrinsic value (i.e. the pre-reform denarius and the antoninianus) at different face values seems unlikely at best and would likely lead to the continued preferential hoarding of the undervalued pre-reform denarius as seen during the earlier period of Septimius Severus' reign. If no or limited preferential hoarding can be identified, then it is more likely

that the relative value of the pre-reform denarius was adjusted to better reflect its superior intrinsic value.

Whether this premium equated the value of the pre-reform denarius with that of the antoninianus would depend on whether the antoninianus itself was circulating at its intrinsic value (i.e. 1.5x that of the post-reform denarius) or an artificially inflated face value. Should the value of the pre-reform denarius have been increased in response to metallist concerns, it is extremely unlikely that the monetary authorities of the day would have taken an action such as overvaluing the antoninianus (or even overvaluing both the antoninianus and the pre-reform denarius together.) If the populace was able to detect that the pre-reform denarius was undervalued, it would be just as likely to identify that the antoninianus was overvalued and would then take the corresponding action. It is also probable that such official sanction of a premium on post-reform denarii would alert even more of the public to the disparity in intrinsic value between silver denominations, spurring further scrutiny of quality and compounding any effects of Gresham's Law. As such, if the value of the pre-reform denarius was adjusted to circulate at a premium compared to the post reform denarius, it is most likely that the antoninianus also circulated at the same rate.

Denominational system

Scholarship on the Roman monetary system often speaks of the 'Augustan system', a denominational schema which existed from the reign of Augustus to the third century AD.[341] Put simply, the Augustan system is based on a trimetallic system of currencies in gold, silver and base metal, all related to one another in fixed values. The precious metal component of this system comprises a gold aureus valued at twenty-five silver denarii. The validity of describing this as an 'Augustan system' (and even the attribution of its development to Augustus) has been recently challenged in the works of Butcher and Ponting.[342] However the term remains useful shorthand for the 1:25 relationship between the silver and gold coinages, and it will be used here in this sense.

Scholars often point to a passage in the Roman History of the third century scholar Cassius Dio, in which he states 'For I myself call the coin worth 25 *drachmae* (i.e. denarii) a *chrysous* (a Greek calque of the Latin aureus)'[343] when discussing the position of the Augustan

[341] See for example Walker (1978)110; Harl (1996) 73-96;Verboven (2007) *passim;* Bland (2013b) 266.
[342] Butcher and Ponting (2015) *passim*; Butcher (2018) 173-178.
[343] Cassius Dio, *Historiae Romanae* 55.12.3.

system during the early decades of the first century. Kubitscheck believes that the fact that Dio felt the need to include this clarification indicates that the Augustan system had fallen out of use by the time he was writing;[344] Buttrey refutes this point on the grounds that the Greek grammar of the sentence can only be taken in the present tense, and as such Dio must have been referring to the denominational system of his own time.[345]

The major problem with this passage is that it is taken from epitomes by the Byzantine scholars Joannes Xiphilinus (11th Century) and Joannes Zonaras (12th Century), not from an extant copy of Dio's original work. As such it is possible that this section was added later as a gloss for those unfamiliar with the Roman currency system or the use of the word aureus as a noun rather than as the adjective 'golden'. The fact that the alternate readings by Kubitscheck, Buttrey and others rely on interpretations of Dio's intentions in including this statement in his work suggests that it cannot be used conclusively one way or another. This is particularly pertinent given that we are reading Dio's intent through the lens of later epitomisers, rather than directly from the pen of the man himself. Therefore it remains entirely possible that the construction of a new denominational hierarchy, incorporating the new antoninianus and radiate aureus, took place during the early decades of the third century, and we must look for more concrete evidence to examine this change.[346] As elsewhere in this work, I propose that such data would be better sought through an examination of the surviving material evidence.

Should the Augustan system have continued to prevail during Caracalla's reign, the introduction of the antoninianus presents an issue. Presuming that the antoninianus and the pre-Severan reform denarius circulated at parity (as discussed above), if the post-reform denarius continued to have been valued at 25 to the aureus an antoninianus worth twice as much would have been valued at 12.5 to the aureus, limiting the ability to exchange the new denomination for gold. Likewise, an antoninianus with a value of 1.5 times as much as the post-reform denarius. would have been valued at 16.7 to the aureus. Vice versa, should the pre-reform denarius and the antoninianus have been valued at 25 to the aureus, the post-reform denarius would have been valued at 37.5 to the aureus. All of these permutations are impractical, although not impossible. However, as we have seen it is far from certain that the Augustan system was still in use at the beginning of the third century AD. If the system were modified, even slightly, the antoninianus could have been

[344] Kubitscheck (1896), reproduced in Buttrey (1961a) 41-42
[345] Buttrey (1961a) *passim*.
[346] This possibility was proposed in Carson (1965) 227-228.

slotted into the monetary system with a realistic relationship with the aureus and the denarius.

Should the antoninianus have been valued at two denarii, the revised relationship between the denarius and the aureus would need to be divisible by two in order to fit the antoninianus. 24 denarii to the aureus makes the most sense, as this would allow the least adjustment to the familiar Augustan system. It seems most probable that the post-reform denarius would continue to fill the role of 'denarius', as the nominal gold to silver ratio of the currency would remain close to the previous average of 1:12 (at 1:12.6 if we assume a pure aureus and denarius). Presumably the radiate aureus, at twice the weight of the laureate aureus, would hold a value equal to twice as much as its smaller counterpart. In this system, the hierarchy of denominations would therefore be 1 radiate aureus = 2 laureate aurei = 24 antoniniani/pre-reform denarii = 48 (post-reform) denarii. This presents a schema which allows each denomination to be exchanged for the others efficiently.

If the antoninianus was tariffed at 1.5 times the amount of the post-reform denarius, then the number of denarii to the aureus must be divisible by three to allow the antoninianus to slot into the system. Again, 24 denarii to the aureus is the most likely choice. In this system, if 24 new denarii equalled one aureus, and one antoninianus was worth 1.5 times as much as a denarius, then one aureus would equal 16 antoniniani. Including the radiate aureus, this system would equate to 1 radiate aureus = 2 laureate aurei = 32 pre-reform denarii or antoniniani = 48 post-reform denarii. Again the antoninianus fits in neatly, with no awkward remainders.

A third option remains: that the denominational system had broken down in its entirety by the early Third Century, with coinage now circulating by weight rather than by tale. Colin Elliot is a proponent of this view.[347] In Elliot's opinion, the state at the beginning of the third century AD was unable to compel the public to accept coins at their legal face value, and coin users themselves had no incentive to maintain the use of legal values. Elliott believes that the majority of coin users in the majority of exchanges would have determined the worth of precious metal currency through its intrinsic bullion value. However, even if the state attempted to set a legal bullion exchange rate,[348] it is likely that this value will have fluctuated on a local and an empire-wide scale in response to various

[347] Elliott (2020) *passim.*
[348] As Diocletian did in his *Edict on Maximum Prices*, valuing gold at twelve times the price of silver (perhaps attempting to maintain the historical ratio between the two metals).

stimuli. The lack of knowledge of coin values, both in terms of bullion prices and face value, in the Severan period serves to illustrate the complexity of applying the theoretical framework of Gresham's Law to individual coinage reforms and their aftermaths.

To summarise, three potential denominational systems could have been in operation at the time of the introduction of the antoninianus. Firstly, there could be no operating organisational hierarchy. In this case, with the state unwilling or unable to compel value relationships between the denominations in use, Gresham's Law would have no need to operate as coins would circulate at their 'true' intrinsic value. As such, it will not be included in our list of counterfactuals to explore. The 'Augustan' system of 25 denarii to the aureus is the solution which has found favour with the majority of scholars over the past century and has the backing of the limited literary evidence which we possess, but its use would pose exchange issues between the precious metal denominations in circulation. Alternatively, a hypothetical revised 'Caracallan' system of 24 denarii to the aureus, with the antoninianus circulating alongside the finer pre-Severan reform denarius at a value reflecting either their precious metal content or a nominal 'face value,' would allow the precious metal coins to be easily converted from one to another. The latter seems to be the most likely logical choice, but its existence is purely speculatory. Further examination of the potential consequences of the adoption of such a system, and a comparison between its putative effects and the changes to the monetary economy as identifiable through the hoard evidence, could help to confirm or deny any change to the relationships between denominations.

However, the relative value of the precious metal denominations to one another is not the only consideration when establishing if the antoninianus was over- or undervalued. We must also consider the relationship of the coinage to the market value of metal.

The value of gold and silver: coinage and bullion

This issue is further muddied when we begin to question how the relative value of the precious metal coinage relates to that of the unminted bullion in circulation within the empire. Again this is question for which we have very little evidence, and inferences often have to be drawn from circumstantial evidence. From the beginning of the first century AD to the end of the second the theoretical gold to silver ratio (the relative value of gold and silver if the aureus and the denarius were both made of pure bullion) of the coinage hovered between approximately 1:12 and 1:11. Reformers seemingly took great care to maintain this ratio, balancing reductions in the weight of the denarius and the aureus to

ensure that it remained as constant as possible.[349] However, since the time of Nero, reductions in the purity of the denarius meant that the actual gold to silver ratio of the Roman coinage was generally between 1:10 and 1:9, overvaluing the denarius in relation to its theoretical value against the aureus by approximately 25%. Septimius Severus' debasement and the lack of a corresponding decrease in the weight of the aureus changed this ratio once more, increasing the relative metallic value of the silver coinage even further to around 1:5.2. This meant that the silver denarius was now overvalued in relation to its face value by more than 50%.

If the Augustan system of denominations continued to be used under Caracalla, the relative theoretical value of gold to silver was now around 1:13.1 (assuming the post reform denarius circulated at 25 to the aureus and taking into account Caracalla's reduction in the weight of the aureus down to around 6.5g,) The true gold to silver ratio of the aureus and the denarius in this situation would be around 1:6 (a decrease in the value of silver when compared to the coinage of Septimius Severus, brought about by the reduction in the weight of the aureus). Should it have circulated as a double denarius, the true gold to silver ratio between the antoninianus and the aureus would have been 1:4.4, while a 1.5 denarius antoninianus would produce a true ratio of 1:5.9.

As mentioned above, the theoretical gold to silver ratio in a reformed 'Caracallan' system of denominations would be 1:12.6. The true gold to silver ratio between the denarius and the aureus would be 1:5.8, while that between a double denarius antoninianus and the aureus would be 1:4.2.

Regardless of the denomination schema in use, it is evident that the silver coinage was greatly overvalued in comparison to its theoretical relationship to gold. It is also plain that the extent of this disparity had increased dramatically since it was first brought about by the reforms of Nero. However, the impact of this change is dependent on the corresponding relative values of silver and gold in the marketplace.

If the increase in the metallic value of the silver coinage compared to the gold mirrored an increase in the market value of silver, then this would mean that the coinage would be in equilibrium with bullion and silver denominations. An increase in the value of silver bullion is certainly possible, and has been proposed as a consequence of the exhaustion of major Roman silver mines during the later second century and early third century, such as those

[349] Butcher and Ponting (2015) *passim*.

at Rio Tinto in Spain.[350]The silver coinage would therefore not be overvalued (and gold likewise undervalued) relative to their precious metal content, and there would be no impact on the circulation of the currency. Maintaining this equilibrium may even have been the primary aim of the coinage reforms of the early Third Century, as proposed by scholars like Lo Cascio.[351]

However, it is also possible that the rising relative value of the silver coinage outstripped the increase in the value of silver bullion (if any), in which case the silver in the denarius and the antoninianus could be considered overvalued. In this situation coin users would prefer to use silver coins as they would be comparatively more valuable than the equivalent weight of silver bullion. Conversely, gold coinage would be removed from circulation as it would be worth more as bullion. In this case gold would begin to act more as a store of value than as a practical medium of exchange and may have even been melted down to be used in its traditional function as a metal of ornamentation. We would therefore expect to see evidence of the concurrent circulation of antoniniani/pre-reform denarii and post-reform denarii, a possible increase in the hoarding of gold and an increase in finds of gold in non-exchange contexts. If gold coinage functioned largely as bullion and was thus valued by weight rather than its relative worth in silver currency, it is also possible that the mint would grow more lax in controlling the weight standards used to mint the aureus (an effect which can be seen in the gold coinage of the later Third Century).

Given the incredibly high valuation of silver in this schema (the average value of gold to silver throughout the Middle Ages and Early Modern period was between 1:10 and 1:16,[352] and the current gold to silver ratio is approximately 1:40), it is almost impossible that the 1:5.5 ratio represents an undervaluation of the silver coinage and so this scenario will be omitted from the construction of counterfactuals.

The impact of the value of bullion relative to that of the currency would affect all silver denominations equally, so presumably would not impact the hoarding of one denomination over the other. As a result it will be omitted as a variable when constructing the counterfactuals below. However, it is worth bearing in mind the potential effect of

[350] Bursche (1996) 124 and Jones (1980) 161-163.
[351] Lo Cascio (1981) 79.
[352] Chown (1994) 15 table 2.1; the only region with a recorded bimetallic ratio of less than 1:9 is Spain c. AD 1450, a historically low rate largely attributable to the vast quantities of gold being shipped back from the nascent Spanish Empire in the Americas. The rate stabilises by AD 1500.

bullion values on coin usage in general, and we will revisit this issue when examining the hoard evidence.

Counterfactuals

Now that we have worked through the potential outcomes of each of the four variables above, we can identify the scenarios for which it would be beneficial to construct counterfactual histories. These are:

1. Augustan system, antoninianus is a double denarius, pre-reform denarius equates to post-reform denarius
2. Augustan system, antoninianus is a 1.5x denarius, pre-reform denarius equates to antoninianus
3. 'Caracallan' system, antoninianus is a double denarius, pre-reform denarius equates to post-reform denarius
4. 'Caracallan' system, antoninianus is a 1.5x denarius, pre-reform denarius equates to antoninianus

As discussed, it is presumed that where the antoninianus is a 1.5x denarius then the pre-reform denarius would circulate with it at parity (as both changes would have been carried out due to the metallist concerns of the populace, and it would be nonsensical to have one without the other). The circulation of both the antoninianus and the pre-reform denarius at an artificially high face value is ruled out on the grounds that this would be detected by the populace. In the following counterfactuals, it will be presumed that the theoretical ratio of gold to silver between the aureus and the post reform denarius in each system (25 denarii in scenarios 1 and 2 and 24 denarii in scenarios 3 and 4) is the same as operating relative market values of bullion at that time (given its comparability to known historical market values for bullion in the Middle Ages). This ratio is calculated by multiplying the full weight of the Caracallan denarius (3.4g) by the number of denarii to the aureus (25 in the Augustan system, 24 in the 'Caracallan system'). This is the weight of silver which would be equivalent to the aureus if the denarius was minted in pure alloy (as it purported to be). The ratio can then be simplified as follows:

Augustan system – 3.4g x 25 denarii = 85g

Ratio = 6.5 grams of gold: 85g of silver

= 1:13.1

'Caracallan' system = 3.4g x 24 denarii = 81.6g

Ratio = 6.5g of gold: 81.6g of silver

= 1:12.6

All silver coins at this point were overvalued against their theoretical relationship to the aureus due to the effect of ongoing debasement. However as discussed above this should have affected both silver denominations equally, so can be disregarded when comparing the impact on their relative circulation patterns. The more informative comparison would be between the true bullion values of the coins in circulation. The calculation is the same as for the theoretical value, but instead of using the total weight of the denarius we use the weight of pure silver which it contained. For this calculation we will use the silver content of the post reform denarius (1.56g), which as the 'current' denarius standard in production would have represented the state's intended silver to gold relationship.. This generates a Augustan system ratio of 1:6, and a 'Caracallan' system ratio of 1:5.76. By generating the same ratios for each of the other silver denominations in circulation, we can compare them to one another. The relationship of any of the silver coins to one another should be 1:1, while the ratio of silver to gold should be the same as that of the post-reform denarius to the aureus.

In each scenario, the coins could have three potential values relative to one another: undervaluation, overvaluation and parity. In 'ideal' circumstances (in other words, situations in which Elliot's three preconditions for the operation of Gresham's Law are in effect), each valuation would be expected to produce certain effects on the circulation of each denomination. The variance of the material evidence from these 'ideal' counterfactual histories can then be used to explore how the economic circumstances of the reign of Caracalla differed from the model conditions used to establish the counterfactuals.

The following table shows how the coins would relate to one another in each of the four scenarios described above. The ratio provided is that of the true gold: silver relationship in the denomination, while the percentage is the variance from par (1:1 for silver denominations, 1:6 for silver to gold in the Augustan system, 1:5.76 for silver to gold in the 'Caracallan' system):

Scenario 1 Theoretical ratio 1:13.1	Antoninianus		Pre-reform denarius		Post-reform denarius	
Aureus	1:4.52	- 25%	1:9.2	+ 53.3%	1:6	Parity
Antoninianus			1:2	+ 100%	1:1.33	+ 33%
Pre-reform denarius					1.53:1	- 53%

Scenario 2 Theoretical ratio 1:13.1	Antoninianus		Pre-reform denarius		Post-reform denarius	
Aureus	1:6.02	Parity	1:6.02	Parity	1:6	Parity
Antoninianus			1:1	Parity	1:1	Parity
Pre-reform denarius					1:1	Parity

Scenario 3 Theoretical ratio 1:12.6	Antoninianus		Pre-reform denarius		Post-reform denarius	
Aureus	1:4.34	- 25%	1:9.15	+ 59%	1:5.76	Parity
Antoninianus			1:2	+ 100%	1:1.33	+ 33%
Pre-reform denarius					1.53:1	- 53%

Scenario 4 Theoretical ratio 1:12.6	Antoninianus		Pre-reform denarius		Post-reform denarius	
Aureus	1:6.02	Parity	1:6.02	Parity	1:5.76	Parity
Antoninianus			1:1	Parity	1:1	Parity
Pre-reform denarius					1:1	Parity

Table 20: summaries of the outcomes of various counterfactual scenarios concerning the antoninianus.

As can be seen above, there are two possible situations arising from our four scenarios, with the denominational system in use playing a minimal role in impacting the value relationships between the coins. Four counterfactuals can now be distilled down to two broadly similar scenarios, which are:

- The antoninianus is overvalued relative to the gold and both silver denominations, and the pre-reform denarius is likewise greatly undervalued (scenarios 1 and 3).
- All silver denominations circulate at relative parity with each other, although the silver coinage in general may have been overvalued against the gold (scenarios 2 and 4).

In all of the scenarios above it is possible that overvaluation of the silver coinage against the gold, as seen in the disparity between the theoretical and actual bimetallic ratios given, was too substantial and provoked a reaction amongst coin users. This is the case even for scenarios 2 and 4, where the pre-reform denarius and the antoninianus circulate against the aureus at parity with the post-reform denarius. It is almost impossible to identify at what point the silver becomes 'too' overvalued against the gold, particularly as we do not know the true relative market value of gold to silver and as this ratio would vary dependent on time and place. However, it may be possible to identify the effects of such an occurrence in the hoard evidence. As the undervalued metal, gold coin would begin to be treated as bullion and be used as a store of wealth in the form of hoards, jewellery and

plate. It is also possible that the undervaluation of coined gold would limit minting, as with the denarius in the Julio-Claudian period.[353] This issue will be dealt with as we review the hoard evidence.

These counterfactuals, and the hypothetical effects of Gresham's Law that they would entail, will now be discussed in detail.

Counterfactual scenario 1: antoninianus overvalued, pre-reform denarius undervalued

In this scenario, the antoninianus is significantly overvalued. By compelling the circulation of the coin at a face value 33% higher than the intrinsic value of the metal within the coin, the antoninianus would have been around 25% overvalued when compared to the aureus, 33% overvalued when compared to the post-reform denarius and a whole 100% overvalued against the pre-reform denarius.

It was argued above that the silver coinage was deliberately overvalued in relation to the gold from the time of Nero onwards, in order to provide a buffer for the state in the event of fluctuations in the value of silver. This appears to have had the desired effect, with the production of silver coinage increasing significantly after the reign of Nero when compared to the nadir during the earlier Julio-Claudian period. However, the unforeseen side effect of creating a second silver denomination, with one overvalued against the other, generated significant monetary problems (as discussed in the preceding two chapters). The same could be seen again following the Severan debasement of the denarius, and it can be presumed that a similar effect would occur here. In this instance, the major difference is that there are three silver denominations in play.

The antoninianus, being the overvalued coin, would under Gresham's Law become the favoured medium of exchange. Coin users who aimed to conserve as much as possible of the intrinsic value of their coinage would naturally spend antoninianus, and in doing so would effectively receive a 33% boost to the spending power of their silver when compared to market rates. Likewise, the state would benefit from an increase in the supply of money without a corresponding increase in the issue of precious metal, an issue which may have been particularly relevant if we accept that there was a squeeze on the extraction of silver towards the end of the second century AD (a theory discussed above.)

Corresponding to the overvaluation of the antoninianus, the aureus and the pre-reform denarius would have become undervalued. In this situation, Gresham's Law would suggest

[353] See *supra* 47-50.

that these coins would be hoarded, melted down or exported beyond the empire for use as bullion where possible.

Melting gold would yield larger profits than silver, particularly once the costs of obtaining, storing, transporting and melting the coins were taken into account. Gold users would therefore be more likely to reduce their coinage to bullion than silver users (although it is probable that both would occur). This removal of gold coinage would then cause a shortage which could be detected in the extant evidence. However, other period-specific factors such as payments to external tribes and the loss or exhaustion of gold mines may also contribute to any shortage. As bullion is less liquid than coined money, the metal may also have begun to be used as a form of savings or for ornamentation (along the lines envisioned by Constantina Katsari and Roger Bland). A shortage of gold would then lead the economy into a reliance on silver which, as it had become severely and noticeably debased by this time, may have caused a loss of confidence amongst merchants, tradesmen and the military. This lack of confidence in turn would have created financial instability which could have led to the political and social upheaval commonly associated with the third century.

The profit to be gained converting individual pre-reform denarii to bullion would be much less than that obtained from the melting down of aurei, meaning that for the majority of coin users it would not be practical. Therefore, preferential hoarding (as seen under Severus) or export towards the frontiers (as seen with the finds of Augustan silver in India and Sri Lanka) may have been the preferred method of realising the full value of pre-reform coin. However, the usage of silver was much more common than of gold, particularly as monetary taxes were generally paid in denarii,[354] therefore the demand for coined silver was much higher. Again this may mean that selective recycling or export of silver coin would have been impossible for most people and provide a further example of the difference between the strict theoretical application of Gresham's Law and the practical historical realities of ancient economies.

A further possibility for the undervalued coins is that they circulated at unofficial premiums which took into account their superior intrinsic value. Butcher and Ponting proposed such a market in coins as a potential (and possibly undesirable, from an official perspective) outcome of the Neronian reforms.[355] This possibility is discussed at length in respect of the

[354] Harl (1996) 231.
[355] Butcher and Ponting (2015) *passim*.

Severan reforms by Elliott, who proposes it as a means by which the market may have dealt with the co-circulation of coins of different standards.[356] The seeming growth in the demand for currency specialists, the so-called *argentarii* and *numularii*, may have been a direct consequence of the expansion of the need for exchange of coins of differing values.

If this was the case, then the operation of Gresham's Law would have been impacted to the extent that for day-to-day exchange the average coin user had the ability to obtain a fairer price for their coins that the one offered by the state. It may even have had the reverse effect if the state was willing to accept both new and old denarii at the same rate for the payment of taxes; coin users would spend their more valuable older coins in the marketplace, where they could receive a fair rate, and hoard their newer, less intrinsically valuable denarii in reserve for the payment of taxes.

Counterfactual scenario 2: coins circulate at parity

In this scenario, the coinage system would have been structured in such a way as to reduce or even entirely nullify the effect of Gresham's Law. Silver and gold coin would have weight standards and official values which would correspond to their respective market values, and as such there would be no incentive to preferentially hoard, export or melt down any one denomination over the others. Silver may potentially have been overvalued against the gold coinage, as stated above, but silver denominations should have been able to circulate effectively alongside one another. Coins of multiple denominations would be hoarded together and found as site finds together. Individual issues or groups of coins would not rapidly leave circulation, with natural wastage and the introduction of new specie being the major driving forces in the turnover of the currency pool.

This position has often been rejected by scholars on the basis that it ascribes a complexity of economic thought to the Roman administration that was supposedly beyond their means.[357] However, as we have seen with our previous case studies, the Roman state could and would react to economic and fiscal difficulties with manipulation of the currency. It is not beyond the realms of possibility that a particularly observant official would have identified the reasons for which certain groups of coins were being removed from circulation (perhaps even having partaken in such an activity himself) and would therefore have sought to resolve such a situation. Given the parallels we have already identified

[356] Elliott (2014) 140-141; however, Elliott wisely proposes caution when accepting what is largely an *argumentum ex silentio*.
[357] Elliott (2014) 138.

between the Neronian/Domitianic reforms and those under Severus and Caracalla, with the debasement of the denarius creating economic issues which are the subject of subsequent apparently remedial reforms, we can accept a certain level of economic thought may have been in play. However this is not to say that such a position can be accepted without the appropriate pinch of salt; as has already been stated, our counterfactuals are designed to act as heuristic tools for comparison with the material evidence, not rigid models for the evidence to be shoehorned into.

The hoards

Now that we have generated our counterfactuals it is time to review the hoard evidence available for the period AD 213-222, which encompasses the introduction of the antoninianus and the immediate aftermath. As with our previous case-studies, this will be carried out on a regional basis in order to check for any geographic variation in results. The evidence will be summarised below with minimal comment, and then analysed in comparison with the hypothetical scenarios advanced above.

Britain

There are four extant hoards recorded in the dataset as deposited in Britain and ending with coin of the period AD 213-222. Of these, the two deposited during the reign of Caracalla himself (Darfield I and Chadwell St Mary) contain no antoniniani out of 600 silver coins. However the former ends with an issue of AD 213[358] (two years before the date at which the antoninianus was introduced), while the latter ends with a coin dated to AD 213-217.[359] It is therefore entirely possible that these two hoards were deposited prior to the introduction of the antoninianus, and thus no firm conclusions can be drawn from its absence.

The other two British hoards in this period end with coin of Elagabalus. Of these the first (Prestwood A, 111 coins ending with an issue of AD 220) contains four Caracallan denarii and one antoninianus, while the other (Akenham, 59 coins ending with an issue of AD 220-222) contains only two Caracallan denarii and no antoniniani. All four hoards deposited between AD 213 and AD 222 are of the Type B composition identified in the previous chapter,[360] containing a mixture of pre-Severan reform (68.1% for the period) and post-Severan reform (30.3%) denarii. No antoniniani minted by Macrinus or Elagabalus are found in any of the hoards described above.

The proportion of antoniniani in British hoards deposited under Severus Alexander and Maximinus I increases, alongside a general increase in the number of Caracallan silver coins. The large Colchester hoard (*tpq* AD 223) contains 64 antoniniani of Caracalla, 2 of Macrinus and 42 of Elagabalus, out of a total of 3,174 silver coins (0.8% of total.) Antoniniani make up 20% of all coins of Caracalla and 18.7% of all coins of Elagabalus in the Colchester hoard. The Llanarmon hoard (*tpq* AD 226) od 508 coins also contains 2 antoniniani of Caracalla (out of 37 coins of that emperor) and 1 of Elagabalus (out of 43

[358] *RIC* IV 224.
[359] *RIC* IV 308.
[360] See *supra* 122.

coins). The Darfield I hoard (*tpq* AD 235-238) of 478 coins contains 1 antoninianus of Caracalla (out of 19 coins), but none of his successors.

However, the very large Shapwick hoard (*tpq* AD 224) of 8,372 and the smaller St Mary Cray hoard (*tpq* AD 226) of 375 coins contain no antoniniani at all. Given the size of these two finds, we would expect that at least some antoniniani would be included if the hoard was created without bias from the pool of circulating coinage. The exclusion of antoniniani in these instances would therefore seem to be deliberate.

Western Europe

There are five hoards for the period AD 213-222 in the dataset for Western Europe. The earliest, the riverbed deposit from the Adige in northern Italy, comprises 308 silver coins ending with an issue of AD 217. Of these, 8 are Caracallan denarii with no antoniniani. This suggests that the antoninianus was not in widespread circulation in Italy in the immediate aftermath of its introduction, although as with any conclusions drawn from small samples this cannot be stated with any certainty whatsoever.

The remaining four hoards are all from Germany. The earliest, the Mainz III hoard of AD 217-218, contains 51 coins including 3 Caracallan denarii and no antoniniani. The other three (Baden-Baden, Obererbach and Hammermuhle) date to AD 218-222 and contain only two Caracallan denarii and 1 Caracallan antoninianus out of a total of 915 silver coins. Interestingly, the small Baden-Baden and Hammermuhle hoards (17 and 32 coins respectively) each contain a single antoninianus of Elagabalus. All five hoards of the period are Type A in composition, with a total of 91.8% pre-reform denarii.

Under Severus Alexander and Maximinus I there are fourteen Western European coin hoards in or dataset, once again all from modern-day Germany. These hoards contain a slightly larger proportion of antoniniani than their predecessors, with 0.2% antoniniani of Caracalla (9 coins) and 0.3% of Elagabalus (13 coins) out of a total of 3,859 coins. However, it is evident that the antoninianus remained a very small component of the pool of circulating coinage in Western Europe at this time.

Eastern Europe

The Eastern European dataset comprises six hoards for the period 213-222, all with *tpq*'s after the introduction of the antoninianus in AD 215. These hoards contain a total of 2920 coins, and of these there are no Caracallan antoniniani but 139 Caracallan denarii (4.76% of the total for the period). The bulk of these denarii are found in the Barza (Danesti) hoard of AD 222-228, with a total of 118 Caracallan denarii out of 1336 coins in the hoard. As with the British hoards, Macrinian and Elagabalan antoniniani are nowhere in evidence. The Eastern European hoards are of a Type B structure, with 74.8% pre-Severan reform denarii.

There are thirteen hoards with *tpq*'s after AD 222 in the Eastern European region. Again, the antoninianus continues to form a very small proportion of the circulating silver coinage, with only 3 antoniniani of Caracalla (all in the large Deleu hoard) and 7 Elagabalan antoniniani (one from Ercsi and 6 from Deleu) out of a total of 2,763 coins.

The East and North Africa

Finally, the dataset for the East and North Africa contains five hoards for the period AD 213-222 including a total of 2908 coins. One of these, the "Syria" hoard of 261 coins, ends with an issue of AD 213 and as such cannot contain any antoniniani. It does however contain a relatively large number of Caracallan denarii at 13 examples, half of the total amount for the period and approximately 5% of the hoard.

Of the remaining four hoards and 2647 coins, 13 are Caracallan denarii as mentioned above while none are antoniniani, Caracallan or otherwise. As with Western Europe, the hoards are Type A in nature with 2594 (89.2%) pre-Severan reform denarii.

No hoards from the East and North Africa dating to the reigns of Severus Alexander or Maximinus I are available in the present dataset.

Analysis

In the immediate aftermath of the introduction of the antoninianus, almost none can be found in the surviving hoard evidence from anywhere within the Roman empire (4 examples out of 7,872 coins in the current dataset). This applies in regions still experiencing the burst of preferential hoarding of pre-reform denarii brought on by the Severan reforms, such as Western Europe, the East and North Africa, as well as in areas which have begun to see more mixed hoard compositions. Denarii of Caracalla are likewise fairly uncommon, although not to the same extent as their newer counterpart. These hoards would then seem to support counterfactual scenario 1; the antoninianus was worth twice as much as a

contemporary denarius, thus was overvalued in relation to its precious metal content and discriminated against in the creation of coin hoards.

However, the evidence is not a complete fit. In our hoard dataset there is no evidence for an increase in the preferential hoarding of pre-Severan reform coin which our counterfactual would suggest as a consequence of the introduction of the antoninianus as a double denarius. Levels of hoarding of these coins remain the same or lower than those found in hoards ending in the previous decade. Likewise, undervalued gold does not suddenly become a more preferable store of wealth under Caracalla following the introduction of the antoninianus. Gold coin makes up the majority of the wealth stored in hoards in terms of value throughout the Roman imperial period, and the early third century is at the peak of this inclination before a rapid decline in the hoarding of gold from Severus Alexander onwards. However, this is a culmination of a trend beginning under Marcus Aurelius rather than a facet of coin use specific to the reign of Caracalla. In fact, the hoarding of gold coin under Caracalla may even be slightly down on the rate seen under his father.[361]

Once again this illustrates the pitfalls of expecting Gresham's Law to operate as an economic axiom. However, our counterfactual scenarios were never intended to operate as a model, and here they provide a hint that the financial considerations of coin users may not have been the only factors in play when hoards were compiled (at least during the period under review).

If the dearth of antoniniani in hoards of AD 213-222 cannot be entirely explained by the action of Gresham's Law on an overvalued denomination, what other variables could account for it? Coin availability is a major factor in hoard composition; if coins were not part of the general circulation pool in an area, then logically it would not be possible for hoarder to draw them out and deposit them. Why would coins not reach a circulation pool? Slow circulation of coinage in the Roman world is often put forward as an explanation; however, this has been refuted above and will not be returned to here for the same reasons. Is it possible therefore that the coins were not produced in quantity in the first place?

[361] A survey of gold coin hoarding is beyond the purview of this thesis, despite one being sorely needed. However the extensive hoard study carried out by Duncan-Jones provides adequate evidence for comparison; see Duncan-Jones (1994) 68-72, esp. the graph at Fig. 5.4. Katsari also discusses the issue of undervalued gold coinage at length; see Katsari (2011) ch.3.

Production of antoniniani was highly erratic during the reigns of Caracalla, Macrinus and Elagabalus. Caracalla produced denarii and antoniniani in alternating periods from AD 215, while the latter two emperors only minted one small issue each at the very beginning of their reigns. Study of the contents of the Reka Devnia hoard suggests that antoniniani made up around 30% of the silver coin issued under Caracalla from AD 215 onwards.[362] The percentage is even smaller for the reigns of Macrinus (2.4%) and Elagabalus (5.6%). Given the very small numbers of denarii in the hoards from the reigns of each of these emperors, it is not surprising that the number of antoniniani found is likewise minimal.

Hoard evidence has been used to argue that coin production from the reign of Augustus to that of Nero was sporadic at best, and almost non-existent at worst (particularly in the period AD 37 – AD 64). As discussed in an earlier chapter, Butcher and Ponting suggest that this is reflective of an increase in the market value of silver bullion and a subsequent increase in the production cost of silver coins until they became unprofitable to mint. This lack of output was the driving force for the Neronian reforms, wherein the denarius was overvalued to provide a buffer against fluctuations in market values. As the coins are largely of the same metallic value (give or take the occasional very minor adjustments in weight) as the well-represented Republican denarii which preceded them, production difficulties rather than hoarding preferences have been advanced as the reason for the lack of these specific issues within hoards.

Is it possible that the absence of antoniniani from third century coin hoards may mirror that of Julio-Claudian denarii from those of the first century, reflective of an increase in the value of silver rather than prejudice against the new denomination on the part of coin users? It has been argued that silver was becoming scarcer during the latter second and early third centuries due to a combination of conflict, mine exhaustion and increased demands on bullion reserves. This has even been extended as a rationale behind the reforms of Septimius Severus. It is possible that Caracalla or his administration identified that the reforms of his father did not extend far enough in the overvaluation of the silver coinage, and that it was still difficult to produce silver coinage at cost or at profit. The introduction of the even more overvalued antoninianus continued the manipulation of the currency in an attempt to find the 'sweet spot' at which silver could be minted efficiently, an attempt which proved ultimately unsuccessful. Production of silver coins remained low when compared to that under previous emperors, leading to a limited number of coins of

[362] Duncan-Jones (1994) 139-140.

Caracalla, Macrinus and Elagabalus in hoards and the hiatus on antoninianus production from AD 219-238.

This argument is supported by the fact that Caracallan-standard antoniniani are also relatively uncommon as site finds. If the coins were produced in quantity but were omitted from hoards due to a perception of inferiority, then we would expect that they were instead being used in day to day exchange and should turn up more commonly than other contemporary precious metal issues as single finds. This is tempered by the fact that precious metal coins in general are uncommon site finds as they were less commonly used in transactions and would occasion a more thorough search if dropped or lost, but a comparative analysis should at least indicate relative production rates.

Of the 31 silver coins of Caracalla recorded on the British Portable Antiquities Scheme database with confirmed issue dates of AD 215-217, only 7 are antoniniani. Likewise, for Macrinus only two of 23 silver coins are antoniniani, and for Elagabalus there are 17 antoniniani out of 489 silver coin finds. This pattern can also be seen in other regions of the Roman empire. For example, at the well-studied Romanian auxiliary fort at Porolissum, only two antoniniani of Elagabalus has been found as single finds in contrast to 14 denarii dating from AD 211-217. An extensive survey of site finds is beyond the purview of this thesis, but it should be considered as a future project as it would provide a valuable viewpoint to allow contrast with the hoard data.

Following a strict reading of Gresham's Law, the 'bad' antoninianus should have forced the 'good' denarius from exchange and thus should be more common as a site find. The evidence provided by the site finds above would seem to demonstrate that this is not the case, and instead indicate that the antoninianus was a minor component of the circulation pool in general. In turn, this suggests it was not struck in large quantities at all, a conclusion which supports the theory that silver coinage production on the standards used in the second century AD was not practical in the third century.

How then to explain the apparent preferential omission of antoniniani from coin hoards such as Shapwick? It is clear from these finds that some coin users could, and would, discriminate against the new denomination in hoards. It is possible that the answer lies in the conflict between the chartalist aspects of the Roman currency and the metallist preferences of the population who used it.

Trust was a major factor in the circulation of Roman coinage. The production of coinage of a high standard was a prime concern of the imperial administration; the second Neronian and first Domitianic reforms can both be seen as a desire to return the silver coinage to as close to purity as possible, while Trajan may have openly advertised his recall of old coins in terms which suggest that this action was taken to ensure a quality coinage supply. The emperor himself implicitly guaranteed the value of the precious metal coinage by stamping it with his image, and thus public trust (or lack thereof) in the emperor was transferred to the coinage. As the majority of people would have been unable to accurately calculate the precious metal content of the coinage in common use (even taking into account potential improvements in public knowledge at the start of the third century AD), this trust that the coins contained what they were expected to was a vital element in their proper circulation and use. Vice versa, if a coin became tainted with the suspicion, accurately or not, of debasement or inferior quality, then they could be treated very differently to their more favoured counterparts.

The introduction of a new denomination was a big shift in the hierarchy of the Roman coinage, one which had not been taken in over two centuries. It is only natural that this new denomination did not benefit from the popular goodwill afforded to its more venerable counterparts, particularly if it was in actuality overvalued and this fact had been recognised by some sectors of the coin-using public (although this still may not have necessarily been the case.) If the coin was not trusted as a store of value, then the public would have been reluctant to include it in hoards regardless of its actual precious metal content and face value. This would have no impact on the treatment of other precious metal denominations still in circulation. Thus, the exclusion of the antoniniani from certain hoards without the attended changes to the treatment of other gold and silver issues in circulation need not become an issue when reconciling the hoard evidence to our counterfactuals.

The surviving literary evidence would seem to support this notion. Dio (in the epitomes of his work produced by Xiphilinus) refers to the coinage of Caracalla as 'dishonest,' and goes on to elaborate that:

> *The gold and silver that he gave to them* [the Free German tribes] *was of course genuine, whereas the silver and gold currency that he furnished to the Romans was*

debased; for he manufactured the one kind out of lead plated with silver, and the other out of copper plated with gold.[363]

This passage of Dio is only found in one extant copy (the *Excerpta Valesiana*) of an epitome by a later author, so cannot be treated as conclusively contemporary. In addition, Dio's statements here are not entirely accurate; antoniniani are not made from silver-plated lead (nor are Caracallan aurei gold-plated copper), and no special issues of pure gold and silver coinage appear to have been produced for export. However they may reflect a general suspicion (at least among the literary classes during the third century) that Caracalla's coinage was not to be trusted.[364] If this opinion was more widely held, then it could have impacted upon the treatment Caracallan currency received in the hands of general coin users. People wary of the metallurgical integrity of the antoninianus or unaware of its position within the denominational hierarchy would have discriminated against the coin as a store of wealth, creating the hoards which exclusively contain denarii. Likewise, those coin users who were better informed, who had less concern for the intrinsic value of the coinage or whose financial situation meant that they would be willing to hoard any coinage would compose the more mixed finds. With a certain level of bias against the Caracallan standard antoninianus, we would expect the coins to have a long circulation life as they would not be preferentially removed from the circulation pool. If this is the case, it will become evident as we examine the later hoards in our dataset.

A level of distrust (warranted or otherwise) for the antoninianus may help to explain why the denomination was discontinued under Macrinus, Elagabalus and Severus Alexander. The imperial household took responsibility for the precious metal coinage, and it is well documented that the fineness of the currency was a moral equivalent to the rectitude of the emperor in ancient thought. Macrinus, Elagabalus and Alexander, by 'restoring' the coinage, could present themselves as the moral saviour of the Roman world as well. This was a common trope in ancient imperial iconography, and this theory is supported by the fact that Severus Alexander issued coins with the legend RESTITVTOR MON(eta), 'the restorer of the currency' (utilising similar language to that around the Trajanic coinage recall.)[365] Unlike the similar attempt at currency 'improvement' under Domitian in AD 85, however, Alexander was in fact continuing production of the newer, less intrinsically

[363] Cassius Dio, *Historiae Romanae* 78.15.1 (translation in Bland (1996) 75).
[364] The author has previously advanced a similar argument for comments made by Pliny on the 'legionary' coinage of Mark Antony; see Murphy (2015) 22 *et passim*.
[365] RIC IV 601.

valuable coin. This suggests that the post-reform denarius may have been seen in some quarters as the superior denomination to the antoninianus, despite the improved intrinsic value of the latter.

Conclusions

Antoniniani on the Caracallan standard are found in limited numbers in coin hoards from across the Roman world in the decades after they were issued, generally alongside more the more numerous denarii. The introduction of a new coin does not appear to spur an episode of preferential hoarding of the post-reform denarius (as would have occurred if the state attempted to enforce an artificially high face value for the finer coins). This suggests that the antoninianus was intended to circulate at a rate commensurate with its precious metal content i.e. 1 and a half times the value of the contemporary post-reform denarius. It therefore was not over or undervalued when compared to other denominations, and there would have been no need to hoard it to the exclusion of the denarius.

This indicates that the antoninianus was not a disguised debasement, as the limited ancient authorities and the majority of modern scholarship would suggest. Instead it appears to have been introduced for another purpose, most likely as a revival of the pre-Severan reform denarius and an explicit condonation of the circulation of these coins at a premium when compared to post-reform denarii. The introduction of a new, visually distinctive denomination as opposed to a simple reintroduction of the pre-reform denarius standard would have served to make it clear that both silver standards were intended to circulate together, as well as to make it obvious which the more valuable coin was. It may even have been the case that Caracalla ultimately intended to recall and remint pre-reform denarii as antoniniani, although this is purely speculative.

The hoards contain a very small number of antoniniani, which historically has been taken as an indicator that the coin was 'unpopular' due to its overvaluation and as such was subject to the action of Gresham's Law. However, this theory does not track with the rationale for the antoninianus as proposed above, so here an alternative suggestion is made. The antoninianus was not economically viable to produce due to changes in the market value of silver (as was the case with the pre-reform denarius under Septimius Severus, and as will be discussed further below), and so was minted in relatively small numbers. This is evidenced through the fact that the coin is not found in quantity in site finds, as it should have been if it had preferentially displaced the denarius in exchange through Gresham's

Law.[366] This would not have been the case should the antoninianus have been significantly overvalued against other silver denominations through the use of a 'face value' in excess of its precious metal content, as the costs of minting the new coin would have been outweighed by seigniorage. This suggests that no such 'face value' was in place, with any premium enjoyed by the antoninianus over the denarius in line with its superior precious metal content.

However, some hoards (most notably the large Shapwick hoard) do show preference for hoarding denarii to the exclusion of antoniniani. This is more consistent with the idea of an overvalued, debased antoninianus being 'unpopular' amongst the public, but other contemporary finds of mixed silver denominations would count against this theory. Instead, it is likely that these finds are reflective of the imperfect nature of the Roman public's knowledge of coinage manipulation. The introduction of a new denomination, produced in small numbers and with an unusual relation to the more familiar coins in circulation, would likely have been suspicious to a populace many of whom will have lived through the debasement of Septimius. Limited information as to the value of this new coin would have been available to most and, if the passage of Dio discussed above is an accurate relation of the popular opinion of the day, it may not have been entirely accurate. Trust is essential to all monetary use but was of particular importance to pre-modern precious metal currencies. Coin users who did not trust the new denomination would naturally have avoided using it as a store of wealth, and thus would have omitted it when creating coin hoards. Others with better information and/or more trust in the state would have hoarded them without concern, creating the contrasting hoard types discussed above.

The cessation of antoninianus minting under Elagabalus and the exclusive production of denarii under Severus Alexander and Maximinus I is likely to have been as the result of the failure of Caracalla's monetary policy than of the failure of the antoninianus itself. The antoninianus was introduced in order to allow the bulk of silver coinage, the pre-reform denarii minted during the second century AD, to circulate effectively. This measure may have been effective as post-reform denarii begin to be hoarded alongside their finer pre-reform counterparts, as identified in the previous chapter.

[366] Here the potential value of die studies of the Caracallan coinage, similar to those carried out by Carradice for the Domitianic denarius, becomes clear. Such work is beyond the scope of this thesis but would be a crucial piece of additional information for future scholars on the subject.

However, as with the heavy, pure AD 82-85 denarii issued under Domitian, the antoninianus did not take into account the circumstances which necessitated the reform of the denarius in the first place. Rising silver prices, caused by a range of factors such as the exhaustion of major silver mines and an increased demand for currency generated by the increased monetisation of the economy, made the denarius uneconomical to mint when compared with the aureus. The fact that Caracalla continued to mint the post-reform denarius alongside the antoninianus, as well as only producing antoniniani in limited numbers, may be indicative of the fact that production of the new denomination proved difficult. Both Macrinus and Elagabalus, recognising the problem, reverted to solely striking denarii on the post-reform standard. Either Elagabalus or his successor Severus Alexander then initiated a recall of pre-reform denarii to eliminate the unofficial two-tier exchange system which had developed. This ties in with our findings in the previous chapter, where the number of pre-reform denarii in hoards declines dramatically from the reign of Severus Alexander onwards. If the antoninianus was intended to circulate at parity with the pre-reform denarius then we would likewise expect those struck on the Caracallan standard to have been withdrawn at this time, but as discussed above the number of these coins in hoards was never very high to begin with and such an assertion cannot be made with confidence.

Where does this leave our counterfactuals? It is evident that neither scenario fits the extant hoard evidence completely; scenario 1 does not explain the lack of increased hoarding of undervalued aurei and pre-reform denarii and the apparent inability of the state to produce the antoninianus economically, while scenario 2 does not fit in with the initial lack of antoniniani in hoards and the apparent incidents of preferential hoarding of denarii seen at Shapwick and elsewhere. Of the two, scenario 2 seems the more probable. However, the counterfactuals were never intended to perfectly describe the circulation life of the antoninianus, but rather to act as indicators to potential difficulties in the heavy-handed application of Gresham's Law. Contrasting the counterfactuals to the evidence flags up points of interest in the hoard data, and examination of these is what prompts us to look at the wider social and economic context of hoarding in order to generate the narrative theory given above. This schema can then be reviewed as more and more hoards and contextual evidence become available, and our counterfactuals can be tested in more depth.

Having reviewed the initial fortunes of the Caracallan-standard antoninianus, we will now review the hoard evidence for the period from the reintroduction of the coin in AD 238,

through the complete cessation of denarius production in AD 241, to the end of the reign of Trebonianus Gallus in AD 253.

Balbinus and Pupienus to Trebonianus Gallus (AD 238- 253)

This period covers the reintroduction of the antoninianus under the joint emperors Balbinus and Pupienus to the reform of the antoninianus under Trebonianus Gallus in AD 253. As detailed in the table above, the silver content of the antoninianus seems to have declined in this period from the Caracallan standard to around 1.89g per coin. Henceforth we will term this the 'Gordianic' standard, and the potential rationale for the change will be discussed further below. However as above we will commence with a review of the hoard evidence for this period.

The hoards

Britain

There are seven British hoards in our dataset with *terminus post quem* between AD 238 and AD 253, containing a total of 3,615 silver coins. The initial three hoards, all deposited under Gordian III, continue to contain very few antoniniani at all. The small Hartlebury hoard contains only 56 denarii, the Standish hoard contains a single antoninianus of Elagabalus and 97 denarii, and the much larger Dereham hoard contains 4 antoniniani of Caracalla, 5 of Elagabalus and 7 of Gordian III out of a total of 1,092 silver coins. In all the antoninianus makes up around 1.3% of coins in these three hoards, and the bulk of their contents continues to be the post reform denarii of Septimius Severus and Severus Alexander. This indicates that the initial reintroduction of the antoninianus under Balbinus and Pupienus had minimal immediate effect on the composition of hoards in Britain.

However, of the contents of the four hoards deposited between AD 248 and AD 253, 549 antoniniani make up a total of 23.1% of coins, a dramatic increase. These are overwhelmingly antoniniani of Gordian III and his successors, with only 13 antoniniani of Caracalla recorded. This demonstrates the speed at which the Gordianic standard antoninianus entered the circulation pool and began to displace the denarius once production of the latter had been discontinued. Interestingly, in this period the antoninianus increases significantly as a proportion of all of the coins of Caracalla contains within hoards to around 26% from 5.13% in the previous three finds. We will touch again on this issue below.

Western Europe

There is a substantial dataset of twenty hoards from Western Europe with *tpq*'s between AD 238 and AD 253, containing a total of 4,759 silver coins. The five hoards deposited during the reign of Gordian III are very similar in composition to their contemporary counterparts from Britain, containing only 55 antoniniani out of a total of 2,260 coins (2.5%). Of these, again the bulk are the antoniniani of Gordian III himself, with only 6 antoniniani of Caracalla, 3 of Elagabalus and 1 of Balbinus found.

The latter 15 hoards also show an even more rapid increase in the representation of the antoninianus, which makes up 43.5% of the 2,499 coins deposited. These are overwhelmingly Gordianic standard antoniniani. The speed of this change when compared to Britain is likely due to the proximity of this region to the mint and the apparatus of coinage distribution, as well as the relative monetisation of the area and the concurrently higher rate of coin circulation. The 6 antoniniani of Caracalla recorded make up 13.64% of all of the coin of that emperor, again showing an increase from the 3.8% seen in the previous five finds.

Eastern Europe

A huge number of finds are recorded from Eastern Europe in the period under discussion. The 39 hoards contain a total of 17,501 silver coins, by far the biggest dataset for any of our regional studies. The trends observed in Britain and Western Europe appear to continue; the initial finds contain a very small number of antoniniani, which increases rapidly following the cessation of denarius striking in AD 241. The first five hoards, with *tpq*'s to AD 241 (Dragasani, Taga, Vartop, Dobridor and Mangalia IV), contain a total of 1291 silver coins. Of these, only 17 are antoniniani (1.3%). The shift following the cessation of denarius production can then be observed most clearly in the Potaissa hoard which closes with a coin of AD 242/243. Of the 211 coins in this hoard, just under half (105) are antoniniani of Gordian III with the remainder being denarii of Septimius Severus and Severus Alexander.

Following this, Gordianic standard antoniniani make up around 42.5% of the silver coins found in the 15,999 coins in 33 hoards deposited AD 243-251, a proportion closely following the Western European finds and significantly up on those from Britain. The representation of the antoninianus in the coinage of Caracalla found during this period likewise increases to 14.33% from 3.79% in the previous finds.

East and North Africa

Only three silver coin hoards are recorded from the Eastern Roman empire during the period under review. These are the Yatagan hoard of 243 coins (*tpq* AD 243), the Gush Halav find of 22 coins (*tpq* AD 244-249) and the Dura Europos 7 hoard of 141 coins (*tpq* AD 251-253). All of these hoards were deposited once the denarius had been replaced in production by the antoninianus, so we would expect the Gordianic standard coinage to be found there in significant numbers. Interestingly however the representation of the antoninianus appears to be much lower than in the other regions studied with only 75 examples (18.4% of total) found in the Dura Europos hoard. These figures must be taken under advisement given the small sample size but suggest that the antoninianus was not as quickly adopted in the frontier regions of the east as in continental Europe and Britain. However, given comparison with the previous hoards from the area it indicates that the general pattern of the replacement of the denarius with the antoninianus in circulation from AD 241 onwards holds.

A study of the relative populations of Caracallan denarii and antoniniani is not possible for this region due to the limited sample size.

Analysis and conclusions

It is evident from the hoard data discussed above that the antoninianus rapidly became the major component of the Roman silver coinage on the cessation of denarius striking in AD 241. This point has long been recognised by scholars and is reaffirmed by this study.[367] But what can the hoard data show us about the rationale behind this shift and reactions to it?

The Gordianic standard antoninianus was produced in huge numbers from AD 238 onwards, as evidenced by the increasing quantity and size of hoard finds from this period. The 'success' of this second iteration of the antoninianus when compared to its predecessor has been ascribed by both Elio Lo Cascio and Roger Bland to a retariffing of the coin from two to one and a half denarii, reducing its overvaluation and making acceptable to the public at large.[368] As discussed in the previous section, the antoninianus is unlikely to have been introduced by Caracalla at a 'face value' of two denarii, instead probably circulating at a value of 1.5 denarii. Also, as Koenraad Verboven has pointed out, if the antoninianus was retariffed to 1.5 denarii and the two silver denominations circulated at

[367] The exact timeline of this shift has been refined over the years, but the general point has been recognised since at least the early 20th century in the writings of Rostovtzeff; see Rostovtzeff (1926) 417.
[368] Lo Cascio (1984) 139-144; Bland (1996) 75-76.

parity from the reign of Gordian III onwards then what would be the purpose in replacing the denarius with the antoninianus?[369] Both coins could have circulated effectively alongside one another and could have remained in use together, preventing what would presumably be a costly recall and reminting of the denarius and maintaining the money supply.

It seems much more likely to me that the reverse would occur at this point. Caracalla and his successors, having introduced the antoninianus to deal with the problems caused by the relative valuations between silver coins on different standards, would have taken care to ensure that the original antoninianus fitted in to the denominational schema and valued it at a rate intended to reflect the relative value of its precious metal content. However given the economic difficulty of producing the heavy silver Caracallan antoninianus Elagabalus was forced to discontinue it (much as Domitian had been forced to reverse the reform of AD82).

Gordian (and his successors), on the other hand, would have needed to take no such precautions as he intended to replace the denarius outright. If the relative market value of silver continued to rise, as suggested by the continuing decline in the weight of the silver coinage, further overvaluation of the coinage in production would have been required in order to make it economical to mint silver specie and to hedge against future increases in the value of silver (as was seen under Nero and Septimius Severus). Gordian could carry this out by reintroducing the antoninianus at twice the relative value of the denarius it replaced, overvaluing it by 25%. This overvaluation would make the production of the silver coinage more economical for the state and allow the new denomination to be struck in the large quantities seen in hoards (in contrast to the more modest issues of Caracalla, Macrinus and Elagabalus.) The slight debasement of the silver alloy used, and the more significant reduction in the weight of the Gordianic standard antoninianus when compared to the Caracallan, would further contribute to this overvaluation.

Why Gordian would continue to mint the denarius for three years alongside the antoninianus is unclear. It is possible that he intended the two denominations to circulate together initially, much as Caracalla and his successors had, perhaps to avoid an expensive and administratively challenging recall. When he saw that the two denominations were incompatible he may have chosen to continue with the antoninianus at the expense of the denarius, particularly if he had divined the reason behind Elagabalus' discontinuation of the

[369] Verboven (2007) n.6.

Caracallan standard antoninianus. However in this case, and presuming Gordian introduced his antoninianus as a double denarius, we would expect to see a period of preferential hoarding of the undervalued denarius for the first three years of his reign. As all denarii would be equally affected it would be difficult to determine whether this took place, given that there were very few non-denarius silver coins in circulation at this point with which to compare them. A general increase in the rate of hoarding or the size of individual denarius hoards at this stage may be indicative that the denarius was being driven out of circulation, but this is not evident from the limited sample available to this thesis. This is a question that could potentially be revisited as our recording of hoard finds improves.

Another question raised by this account is why Gordian would have chosen to amend the relationship between the silver and the gold coinage by completely replacing the denomination in use, rather than by simply debasing the silver content of the denarius as with previous reforms, is uncertain. As we have seen in our previous case study, the general public appears to have been much more sensitive to changes in the weight of the coinage than in the silver content of its alloy. As such they would be much more likely to detect a debasement carried out through overvaluation by weight as in this instance. It is possible that Gordian was sensitive to the fact that increasing metallurgical debasement of the denarius would have been obvious to the coin-using public as the colour of the coinage changed and surface silvering became less effective. He may have turned to the antoninianus as an opportunity to disguise his debasement as the introduction of a new denomination, maintaining the pretence that it contained the appropriate amount of silver in order to maintain public trust in the coinage. However it is evident from the events of the following decades that this façade did not last, with the antoninianus rapidly declining to little more than a silver washed base metal coin.

This is likely due to the fact that this is the point in Roman history where we must proceed with greater caution when discussing the denominational hierarchy in use. Roger Bland has noted that from the reign of Severus Alexander onwards the weight of the aureus begins to deviate significantly from the mean, suggesting that control over the production of the coin was no longer as close as it has been. As Bland notes, this would place significant strain on the relationship between the aureus and the other denominations in production and may even have led to a complete breakdown in the denominal link between the silver coinage to the gold. It is possible that the gold currency increasingly began to be valued as bullion during the third century with no seigniorage or overvaluation of coined metal (as suggested

by the identical valuation of gold coinage and bullion in the Diocletianic *Edict on Maximum Prices*).[370]

If this is the case then it is possible that the antoninianus either became the new measure of value with all other denominations as its fractions or multiples or, more likely, that currency exchange became driven by market forces rather than legal relationships as the silver currency became untethered from the gold. This is indicated by the shift in the position of the denarius from physical specie to a notional unit of value, the 'denarius communis.'[371] Quoting prices in an artificial unit of account would allow for any coin to be used to pay debts, with its valuation determined by the market. This hypothesis is largely speculative, but it would begin to explain how antoniniani with widely variable intrinsic values could circulate and be hoarded together in the third century.

This shift in value judgement and the 'collapse' of the denominational hierarchy would then go some way to explaining why Gordian and his successors swiftly abandoned the pretence that the antoninianus contained twice the silver of the denarius which it replaced. With coins now valued on a market basis, the reigning emperor could debase the currency significantly confident that it would continue in use. Over or undervaluation could no longer drive denominations out of circulation, as the floating market value of coinage would protect against this. Increasing debasement would allow emperors, many of whom faced a variety of internal and external threats to their rule, to quickly raise capital to fund the operation of the state (particularly the military).

With the introduction of the antoninianus and this discontinuation of the denarius, it is probable that Gordian III would initiate a recall of older coinage (in this case, all denarii still in circulation) to allow his new denomination to circulate effectively and to raise funds. As seen in the previous case study, this theory is supported by the fact that denarii decline dramatically in discrete numbers and as a proportion of coins in hoards, including denarii untouched by previous recalls such as the legionary coinage of Mark Antony. The denarii recovered in this way would likely have been recycled into antoniniani, providing a source of silver bullion to allow for the dramatic increase in mint output (although this will only be confirmed through isotope analysis.)

The increasing proportion of antoniniani as a component of all coins of Caracalla in hoards is another point noted in the analysis above which supports this proposition. The denarii of

[370] See *supra* 169.
[371] Elliott (2014) 140-141.

Caracalla were recalled and reminted from Gordian III onwards, while his few antoniniani were left untouched and therefore increased as a component of hoards. This demonstrates that the distinction drawn during the recall was between denarii and antoniniani, not antoniniani of different standards, suggesting that the elimination of the older denomination (as opposed to all finer coinage) was the primary goal.

Valerian and Gallienus to Aurelian (AD 253-AD 275)

We can conclude our case study with a note on the hoards deposited from the end of the reign of Trebonianus Gallus in AD 253 to the reform of Aurelian in AD 275. During this period the antoninianus was repeatedly debased until it became no more than a silver washed billon coin. The rapid decline in the silver content of the coin, and the impact of it, is a substantial topic which is beyond the scope of this thesis.

The hoard evidence for this period is plentiful, reflecting the dramatic uptick in the rate of silver coinage production occasioned by the switch to the antoninianus. However unlike with the earlier finds a region by region analysis is not necessary. All hoard finds from all regions contain an overwhelming (over 99%) proportion of antoniniani from Gordian III and later. The denarius has been almost comprehensively removed from circulation at this point, with only a few post-reform outliers included in hoards where available. Antoniniani of Caracalla continue to be scarce but present, and also to increase as a proportion of all silver coins issued under that emperor. The only hoard to deviate at all from this pattern is the Haydere hoard from modern-day Turkey, which contains around 48% denarii, including 25.6% pre-reform issues. However, this hoard is evidently an outlier, and does not alter the bulk of the evidence available.

Conclusions

The antoninianus introduced by Caracalla in AD 215 was a dramatic reinvention of the pre-reform denarius which still circulated in significant numbers. By resuming production of coins on this standard, Caracalla followed in the footsteps of his predecessor Domitian in attempting to allow two coins of differing standards to circulate side by side. The novel approach of introducing a new denomination may reflect the increasing strain on the denomination hierarchy at this time. However, the experiment was unsuccessful due to the increasing price of silver bullion; the coins were produced in limited numbers and then discontinued entirely after only four years. This is reflected by the absence of the Caracallan standard antoninianus from hoards and from site finds across the empire.

The denomination was revived under Balbinus and Pupienus with an increased face value when compared to the denarius and the aureus, seigniorage to hedge against the economic difficulty in producing the coin. The denarius was then discontinued entirely under Gordian III to be replaced by the antoninianus, with the former coin being recalled and quickly displaced in circulation and in hoards by the huge numbers of the latter which were produced. The reintroduction and the rapid deterioration in the silver content of the antoninianus at this time probably does not reflect a change in the bullion value of silver, as has been argued for previous reforms. Instead it is probably indicative of a wholesale change in the nature of Roman currency, with a shift from smaller volumes of precious metal coinage towards high quantities of almost entirely fiat currency. As noted by Rathbone and others, this change may have been intended to deal with the ever-increasing monetisation of the Roman economy and the restrictions placed on metallist coinage by the supply of raw materials.[372] This would tally with the lack of significant evidence we have for dramatic inflation occasioned by an oversupply of money until around AD 274.[373]

The conclusions of this chapter are highly speculative, and much more work is needed to confirm or deny them. In particular, a detailed analysis of the relative proportions of post-Gordianic antoniniani, carried out in light of new data as to the precious metal content of those coins, would be invaluable. In addition, more study of the composition and usage of the aureus would shed light on the role of the gold coinage at this time, and therefore clarify the position of the silver in relationship to it. Despite this, it is hoped that this case study generates some debate around long-standing scholarly positions of the antoninianus, and in turn improves our understanding of this critical period in Roman history.

Conclusions: reform, recognition and reaction

The Roman economy was more monetised that any that had come before it, underpinned by the most advanced system of coinage heretofore seen in the Western World; a trimetallic hierarchy of interchangeable denominations with fixed relationships and a certain degree of reliance on state fiat. Throughout the several centuries of its existence, the currency underwent several reforms, recalls and renewals which had far-reaching impacts on the circulation and use of the coinage. Given the interrelationship between the

[372] Crawford (1975) 567; Rathbone (1996) 338 *et passim*; Haklai-Rotenberg (2011) 21-22.
[373] Rathbone (1996) 329-334.

economy and other aspects of Roman life, these changes in turn influenced the wider social and political landscape.

The exact nature and scale of these changes has been a source of scholarly debate for decades. We have precious little evidence for the social aspects of the Roman economy; contemporary insights into official and popular attitudes and responses to the coinage, the thought process which guided the creation of coin hoards, context surrounding the activities of exchange and so on. What we do have in huge and ever-increasing quantities is surviving coin finds, in the form of both coin hoards and single finds. Analysis of these finds on an individual level is liable to be affected by the same biases which fed into the deposition of the material in the first place. However, the improvement in both the quantity and quality of coin hoard reporting now enables scholars to examine huge quantities of data on both a regional and empire-wide level. By doing so, we can limit the impact of contextual weaknesses in individual finds and generate much more robust hypotheses as to the effect of coinage manipulation on the monetary economy.

This is not the first attempt at such a wide-ranging analysis of coin hoards, as the numerous works discussed in the literature review at the start of this thesis demonstrates. However prior attempts have often been drawn into a common pitfall in numismatic studies; as coin hoards can be examined empirically, so can the results. Scholarship in ancient numismatics is awash with reference to economic 'laws' and 'axioms,' often cited with little or no discussion of context or veracity. The most egregious of these in studies of debasement is 'Gresham's Law,' boiled down to the mantra that 'bad money drives out good.' However, as discussed in the opening chapter, modern scholarship has begun to be more wary of such economic shorthand, as exemplified in the works of Colin Elliot. This is a development which has been continued throughout this thesis.

By looking at material evidence in aggregate, this thesis attempts to both iron out the deficiencies in single coin hoards and also to allow for comparison between regions of the empire and beyond. Having gather our data, we could then work backwards, with the appropriate degree of caution, to the root causes of changes to the coins and their use, topics which have hitherto been the subject of speculation or overreliance on one or two pieces of literary or epigraphic evidence. While not a perfect solution, this provides a line of enquiry which can be supported by reliable, quantifiable evidence and set in contrast with written sources and other extant economic data.

In the introduction to this thesis, we set out a series of questions to guide our enquiries. These were:

- Was the general Roman populace aware of coinage reforms? How did they become aware?
- If so, how did they react? Was the public response to coinage reform always the same? If not, why?
- Were reactions to coinage reforms uniform across the Roman empire? If not, why?
- Were there different responses to coinage debasements and coinage improvements?
- Is Gresham's Law a suitable model for public reactions to coinage reforms?
- Can hoard studies illustrate the rationale behind and effects of coinage reforms? Are there any commonalities between coinage reforms during the Roman imperial period?
- What was the effect of public reactions on the monetary economy and wider Roman society?

Having completed our study of hoard evidence, we will recap the major findings of each individual case study. We can the review these questions in light of the results. The significance and limitations of these findings in terms of wider study will then be addressed, before we look to the future with suggestions for ongoing work which would add to this field.

The findings

Domitian

The hoard evidence clearly demonstrates that the heavy coinage minted by Domitian in the period AD 82-85 (period 2) rapidly and almost completely disappeared from hoards by the reign of Trajan/Hadrian. The less intrinsically valuable denarii of AD 85-96 are found in hoards into the third century AD but decline at a proportionally much higher rate than the even less pure denarii of AD 81-82.

It is proposed here that the removal of period 2 denarii is indicative of a coinage recall initiated by Domitian, encompassing the reigns of Nerva, Trajan and Hadrian. The loss of these coins from the circulation pool comes alongside the removal of the similarly fine Republican and Julio-Claudian silver still in circulation and is of such a scale and rapidity that only state intervention could be the cause. This recall was an attempt to deal with the economic issues caused by having two competing silver denominations in circulation

concurrently. The nature of these problems demonstrates popular awareness of the coinage reform (likely stimulated by the relatively easy to detect weight increase of the period 2 denarius), and the metallist preferences of the coin using public at the time.

The decline of the period 3 denarius is more likely to have been the result of gradual selective removal over the course of decades. This again shows the popular preference for pure precious metal coinage but indicates that knowledge of metallurgical debasements was more limited than that of metrological adjustments.

Regional variation could be seen in the hoards. Hoards from the frontier regions such as Britain and the Rhine show heavy preferential hoarding of fine period 2 denarii immediately prior to their removal, while hoards from more central provinces like Italy show a more mixed composition. It was suggested that this is indicative of increased awareness of coinage reforms on the frontiers of the empire, but appropriate caution should be taken due to the scarcity of evidence.

The less thorough nature of coinage recall in Eastern Europe was also noted, with fine silver Julio-Claudian, Republican and Domitianic denarii persisting in hoards much later than in counterparts from other regions. A resurgence of Domitianic denarii in hoards during the late second and early third centuries was found in all regions, but this shift occurred much earlier in Eastern Europe. This may demonstrate an influx of fine silver coinage into circulation in this region, possibly influenced by the debasements to the contemporary denarius taking place at the time.

Overall, the hoard evidence confirms the view that the public were alert to the Domitianic series of reforms, strengthening the notion that each action taken (reform, counter-reform and coinage recall) were part of a co-ordinated response by the mint to popular concerns. It also supports the notion that, despite state experiments with overvaluation of the silver coinage from the reign of Nero onwards, the public remained avowedly metallist in their outlook. Regional variation can be seen (largely in the timing of changes), but hoards across the empire were found to be broadly similar in composition to their contemporaries elsewhere.

Septimius Severus and the denarius

Hoards from the reign of Septimius Severus show a marked preference for pre-reform denarii, likely as a result of the debasement of contemporaneous issues. This episode of preferential hoarding demonstrates once again the popular awareness and willingness to

respond to coinage reform, indicating that the metallist preferences seen under Domitian were alive and well in the early third century.

Interestingly, this period of hoard composition ends around six years after it begins in Eastern Europe and a decade after it begins in Britain but continues in other parts of the empire up to the reign of Severus Alexander. The reason behind this rapid shift has been discussed at length, with the author proposing that it is indicative of restricted money supply and/or increasing monetisation within those provinces.

The rapid decline of pre-reform denarii in hoards from Severus Alexander was also identified. The similarities between this shift in hoarding patterns and the one in the immediate aftermath of the Domitianic reforms allows parallels to be drawn between the two eras. Such comparisons allow us to view the introduction of the antoninianus from a different perspective, as was done in the following chapter.

Caracalla and the antoninianus

A analogy was drawn between Caracalla's introduction of the antoninianus in AD 215 and the attempt by Domitian to restore the pure silver Julio-Claudian denarius in AD 82. Both were done to remedy deficiencies in circulation caused by public reaction to a coinage debasement (as indicated in the hoard evidence), but both failed to account for the reason behind the initial currency reform (rising silver prices and the subsequent undervaluation of the denarius against the aureus) and thus were doomed to fail. This narrative is a controversial account of the antoninianus, which is by convention seen as an attempt by Caracalla to carry out a stealth debasement using an overvalued 'double denarius.' However it is one which the author feels is compatible with current evidence, and which is at least worthy of further consideration.

Reactions to the introduction of the antoninianus also provide ammunition for the ongoing debate as to the value of the new denomination. As stated above the antoninianus has been seen as a double denarius almost as soon as it was recognised as a denomination separate to the denarius itself. However this would suggest that it was highly overvalued against the stock of silver already in circulation, and therefore would be expected to drive these coins out of use and into hoards. The same can be said of the similarly undervalued gold aureus. However there is no evidence of preferential hoarding of denarii or aurei in the aftermath of the introduction of the antoninianus, suggesting it instead was tariffed in line with its intrinsic metallic value. This point, as well as providing evidence for the ongoing metallism of the Roman world, also marries up with the rationale for the introduction of

the antoninianus given above. The coin was not a debasement but instead was a restoration.

Following the initial failure of the antoninianus experiment, the coin was reintroduced under Gordian III. This time however it was a roaring success, being minted in huge numbers and rapidly supplanting the denarius as the silver coin of choice. It is proposed here that this is due to Gordian's overvaluation of the antoninianus through debasement, and perhaps even by retariffing the coin entirely. Gordian's motive would have been twofold: to expand the money supply of the empire while also reducing the cost to the state in producing the silver. In this regard the reintroduction of the antoninianus can be seen as an innovation in the vein of the Neronian or Severan reforms; faced with increasing silver prices the emperor chose to hedge against it by reducing the standard of the silver currency. The difference under Gordian is that he appears to have spearheaded a withdrawal of the denarius alongside the introduction of the new denomination, perhaps learning the lessons of his forebears and recognising that it was impossible to have two incompatible silver currencies circulate alongside one another. By doing so, he was attempting to ensure the stability of the currency.

However, whatever Gordian's motives they appear to have been overtaken by the dislocation in the currency experienced in the mid to late third century. As the silver became increasingly untethered from the gold (a pattern which commenced during the reign of Severus Alexander), successive emperors took the opportunity to debase the antoninianus repeatedly. Some were no doubt motivated by profit, but it is possible that other concerns such as rapid monetisation (as suggested by Dominic Rathbone and Kevin Butcher) or the source of funds to pay the increasingly rapacious and mercenary army fed into these decisions. This period of change, lasting no more than half a century, deserves further study building upon the findings presented here.

The answers?

It is clear from our dataset that the Roman public, or at least elements of it, could and often did become aware of coinage manipulation, despite official attempts to disguise the changes through surface silvering and other techniques. The constant revision of modern understanding of the metrology and metallurgy of the Roman coinage speaks to the difficulty of obtaining accurate and reliable data in this regard, but the fact that shifts in coin circulation patterns can be seen in the hoards deposited in the aftermath of each of

the major coinage reforms studied in this work shows that it was not impossible for the Roman coin user.

The mechanics of popular awareness of coinage reform appears to have been influenced by a variety of factors. Initial reforms in the imperial period appear to have become common knowledge through the manipulation of weight standards rather than alloy purity, as evidenced by the popular response to the Neronian reforms (which encompassed a significant decrease in the weight of the denarius) and also to the Domitianic reforms (where the weight of the denarius was restored.) During the Severan reforms, a popular reaction to the change in silver content took place despite the fact that there is likely to have been no corresponding weight change. This is perhaps reflective of the increasing availability of coinage assay services, as suggested by Elliot. A third driver of public awareness and response to coinage reform may have been subsequent actions taken by the state in the form of coinage recall. This is indicated most strongly by the spike in preferential hoarding in British finds of heavy, fine denarii of Domitian issued AD 82-85 seen in the early part of Hadrian's reign, followed by their complete removal from circulation by the death of that emperor.

The level of knowledge of the specifics of coinage reforms often appears to have been imperfect; circulating coins which had a superior intrinsic value to others were instead regarded and treated as debased, and *vice versa*. This correlates with the findings of the authors previous study of the legionary denarii of Mark Antony, which experienced an unusually long circulation life as a result of popular conceptions of inferiority (as supported by statements in the contemporary account of Pliny the Elder). This form of misunderstanding likewise appears to have impacted upon other silver coinages subject to manipulation, particularly the pre-reform issues of Septimius Severus. These coins often appear to have been treated in a similar manner to their post-reform counterparts, and in contrast to the second century denarii which they are much closer to in composition and size.

This popular sensitivity to coinage reform is evident to us through the composition of coin hoards, which answers our second question; coin users often did act upon their knowledge of the differing standards of silver currency in use. This provides support for the view that the Roman coin-using public, or at least those who put together the hoards which have survived to the present day, had strong metallist tendencies when valuing the precious metal currency at their disposal. The fact that reaction to coinage reform can be seen

throughout the period under consideration suggests that this preference persisted, despite the increasingly significant fiduciary element of the silver coinage. The correlates with the evidence discussed during the literature review which indicates that metallism remained the predominant mode of currency valuation in the first to third centuries AD.

However, this response was not universal, with some hoards demonstrating that coin users sometimes did not take action either through ignorance or inability. Nor was it uniform across the breadth of the empire, nor across the span of time we have reviewed. When coinage reforms take place, the natural response of a well-informed person is to obtain the maximum value from their money as their circumstances and personal inclinations will allow. If this is possible as part of the process of exchange, such as in the form of premiums on the value of superior-quality coins, then this represents the easiest and therefore most likely method of value extraction. The existence of such grey-market premiums, and the issues caused by the uneven availability of them across the Roman world, has been proposed as the driving force behind several major coinage reforms of the imperial period, most notably the Domitianic reforms of AD 82 and introduction of the antoninianus under Caracalla in AD 215. If indeed such market premiums were in use (as suggested by several surviving imperial edicts mandating acceptance of various coins at officially sanctioned rates, and as would be likely in an economy with such minimal oversight as the Roman), they are both a response to, and a cause of, coinage reforms.

If intrinsic value could not be realised through exchange, then more drastic measures would have to be taken to achieve maximum economy following currency manipulation. This could take the form of directly treating coinage as bullion through preferential hoarding, melting down or reuse as jewellery or other forms of adornment, or by exporting coin to markets outside the empire where bullion value could be realised.

The most common response to coinage reform is the preferential hoarding of finer silver issues at the expense of their less intrinsically valuable equivalents. This can be seen to a greater or lesser extent in the aftermath of all of the reforms discussed in this work and in all of the regions under examination, as it represents the easiest way for coin users to realise the true value of their silver coins. The use of coinage, particularly gold coinage, as jewellery (as evidenced by the pierced holes to allow for suspension from a necklace, bracelet or earrings) has long been noted as an aspect of the hoards of the third century and perhaps represents an increasing disconnect between the value of silver and gold coins at this juncture. However, no explicit evidence for the use of silver coinage in this way has

been identified. Episodes of export can also be seen, most notably in the case of the very fine C L CAESARES and seated Jupiter types of Augustus during the reigns of his Julio-Claudian successors, although again this appears to have been less widespread than the creation of preferential hoards.

These responses were not uniform across the different regions of the empire. The most common discrepancy is in timing; while similar changes to the circulation pool could happen across the empire, they often take place across a wide span of time. This is particular noticeable during the Trajanic recall of fine Republican and Julio-Claudian denarii, which continue to be found in hoards in Eastern Europe several decades after they have completely vanished from finds in Britain and Western Europe. It has been proposed in this thesis that this is indicative of a much less thorough approach to removal of coin in the Eastern provinces than in those further west. Perhaps state control in these regions was limited and they were unable to compel the recall of finer silver coins? Or perhaps the purer silver issues in the East were those which had been exported beyond the frontiers and made their way back into the empire once coinage debasement had increased their value significantly?

Other regional differences identified include the short period of preferential hoarding of second century denarii in Britain following the Severan debasement in AD 194, or the decline in the proportion of pre-Severan reform denarii in Western European hoards deposited in the period AD 235-244 in contrast to other areas (the reason for which is still unknown.)

Regarding the difference in reaction to coinage debasements and coinage improvements, the most instructive case study has been the Domitianic series of reforms. When Domitian moved towards a return to Julio-Claudian denarius standards in AD 82, the newly minted improved issues of denarii were quickly hoarded by the public and do not appear to have formed a major component of the circulation pool. Following the return to Neronian standards in AD 85, Domitianic denarii became much longer lived and appear in hoards well after the withdrawal of their more valuable predecessors. Here it seems that the response to both changes was the same (preferential retention and withdrawal from circulation of finer issues, with the less valuable remaining in circulation and appearing in hoards deposited much later) with the only difference being the coinage population targeted.

It is clear that there were several potential public outcomes of a coinage reform which could occur in any number of combinations. The wide array of reactions (or lack thereof) to

coinage reforms are a result of the 'unseen' contextual issues discussed earlier; an individual's response is dependent on their personal circumstances, their knowledge and their ability to act upon that knowledge, amongst a wealth of other issues. This highlights why scholars must be careful in their approach to hoard studies. For example, according to Gresham's Law if a coin is undervalued then it should be driven out of circulation and into hoards or the melting pot. However if the owner of that coin is living a subsistence lifestyle, with minimal access to or day to day use of coined money beyond the need to pay those taxes for which monetary payment had been mandated, their immediate need for specie would make radical action to realise the true value of their money impractical. Coin hoards can give us a general overview of the range of popular responses to monetary change; they cannot be used to generate a failsafe, if *x* then *y* guide to what we should expect to see.

It is for this reason that we should not rely on Gresham's Law (or any other monetary or economic model, in fact) to provide a completely reliable heuristic tool to assess the outcome of coinage reforms. The number of variables is too great, and the unknown human element too large, to allow anything more than a general model to be created. This is not to say that Gresham's Law is completely without value. When used carefully as a benchmark against which data can be contrasted, such predictors flag up useful points of contrast to lead us towards an understanding of the socio-contextual issues which create such difficulty in modern scholarship. This approach was trialled during the review of the Caracallan-standard antoninianus and proved to be valuable in demonstrating the impact of the market value of bullion (amongst other variables) on the causes and effects of coinage reforms. It is hoped that this methodology can be refined and implemented in later works to expand our understanding of Roman coinage reform.

In terms of the 'broad strokes' model mentioned above, previous scholarly works have suggested some common themes surrounding currency manipulation in the Roman world and these are supported by our case studies. Coinage reforms, the Neronian and Severan debasements in particular, are often preceded by a period in which the production of silver coinage is relatively restricted. When a debasement occurs great pains are often taken to maintain the weight ratios between the silver and gold coinages, indicating this relationship is key. It is likely that the production of silver coinage was occasionally hampered by a shift in the relative market value of silver and gold bullion, which due to the fixed relationship between the Roman denominations could lead to the denarius becoming undervalued if the relative value of silver increased. This would make the production of silver coinage uneconomical, which given the reliance of the Roman monetary economy on the denarius

would be untenable in the long term. The answer would be to introduce an element of fiat value to the denarius through debasement, thereby overvaluing it as a hedge against market forces.

The initial debasement of the silver coinage often leads to a period of preferential hoarding of the older, finer issues, which would likely lead to other issues in coin circulation such as local shortages of specie or the development of a two-tier exchange system. The official response to this is often in the form of a 'restoration' of the older coinage, either through improvements to the denarius in production (as under Domitian in AD 82) or through the introduction of an entirely new denomination to circulate at a premium alongside older coin as tacit recognition of their superior intrinsic value (as is proposed in the case of Caracalla and the antoninianus.) These 'restorations' did not last, as they would not have taken into account the circumstances which forced the initial debasement of the currency. The improved coinage would be undervalued and therefore produced in limited numbers. Once this issue was recognised, the mint would then revert to producing coinage on the debased standards and instead initiate a recall of the older and finer coins still in use (identifiable as a rapid decline in the proportion of these issues in hoards over successive decades.) This course of events did not proceed identically during both series of reforms, but there are enough similarities in the hoard evidence to indicate underlying parallels.

The repeated reform of the monetary system by its very nature impacted upon the wider economic, social and political aspects of Roman life. However, this is the aspect of debasement which has most frequently been overstated in scholarship on the subject. Debasement and the responses to it are often seen as a slow spiral from the pristine monetary system established under Augustus to the inflationary chaos of the 'Crisis of the Third Century.' This narrative, rooted in the Victorian reading of a 'decline and fall' of the Roman empire and perpetuated by the hyperinflation of the first half of the twentieth century, has gradually been diluted in modern scholarship as our evidence base and our understanding has improved. Debasement did not lead to crippling inflation, nor to a widespread abandonment of the concept of a monetised economy in favour of a barter system. Debasements were not forced by greed or the desperation of an emperor to pay his troops or indulge his vanity. Recalls were not short-term attempts at profiteering. Instead it appears that demand for coin was a major driver of debasement in the first place, as the imperial mint attempted to continue to supply coin while the supply of precious metal failed to keep pace. Recalls were initiatives designed to enable coin to circulate

effectively, with any profit derived from reminting old issues a happy side-effect. The 'Crisis of the Third Century' is no longer an entirely satisfactory narrative.

That having been said, it is clear from the hoard evidence that popular responses to these reorganizations had a significant and ongoing effect on the composition of the coinage in circulation throughout the imperial period. Market forces were the driving force behind the debasements under Nero and Septimius Severus, but it is the public reaction to these events which forced subsequent action under Domitian and Caracalla (amongst others). The introduction of the antoninianus under the latter undeniably changed the face of the Roman economy as a whole, not by spurring on ever-rising prices but by replacing the denarius, the bedrock of the monetary system for over four hundred years. The desire for high quality bullion led to the export of certain coin types beyond the frontier of the empire, while others do not appear to have been acceptable. While caution is urged against overemphasizing the impact of coinage reform, it is important that we also recognise the effects that such changes did have in what was the most monetised economy in the Ancient World.

More questions

This thesis is not comprehensive, and there are many avenues of potentially fruitful research which remain to scholars. One particularly valuable area of research is the gold coinage of the empire. The relationship between the silver and the gold is one of the key themes running through this work, as it appears to have been a major concern of the Roman authorities when carrying out currency reform. However, scholarship focussing on the metrology and metallurgy of the gold coinage is sadly lacking when compared to the silver, with the majority of work to date operating under the assumption that the aureus was essentially pure bullion throughout its production life. Given that there are some indications of a debasement during the mid-third century AD, it would be valuable if this position were reappraised. In addition, a major Achilles heel of this thesis is its reliance on discussion of the relative market values of gold and silver when no reliable evidence of this relationship is extant. An analysis of coin finds could also help to identify changes to the production and circulation patterns of the gold coinage, which may in turn assist in identifying how the value of gold changed relative to the silver. Periods of extensive gold hoarding, or of low gold production, may suggest undervaluation of the aureus and vice versa.

Likewise, a review of the development of the aes coinage would be most welcome. This is the currency which would be used for day to day activity in the majority of the Roman world, and further scholarship as to how it was used alongside the precious metal currency would be invaluable in creating a comprehensive picture of the Roman monetary economy.

A further suggestion for additional research would be to expand the review of coin hoards presented here to encompass the antoniniani and other silver coins produced during the latter decades of the third century AD. It is during this time that the antoninianus rapidly declines in both weight and silver content and is the period most commonly cited as supportive of an economic aspect to the 'Crisis of the Third Century.' The work of Butcher and Ponting is making great strides in improving our knowledge of coinage manipulation at this critical point in Roman history and once this is complete it would be most beneficial if the extant find evidence is reassessed and used to bolster or refute the conclusions provided above.

Site finds form the second strand of surviving numismatic evidence, the one which is more often overlooked in modern scholarship due to the fact that such finds are predominantly of base metal coinage. However, it is site finds which are the more representative of the day-to-day economic realities of the vast majority of Roman citizens, representing as they do the vestiges of common exchange activity. With this in mind, and given the interrelated nature of the Roman coinage hierarchy, a comprehensive review of site finds from across the empire would be a further (if very ambitious) proposal for future work.

A more detailed study of the coinage of Caracalla, encompassing a review of the scholarship to date and updated hoard and die studies, would be of immense worth in addressing the seemingly intractable issues which the introduction of the antoninianus seems to present. Given the value of Carradice's study of the Domitianic coinage to scholars in the field (not least to the author of this thesis), a similar work for the Caracallan era would be invaluable.

Finally, the dataset of published and catalogued coin hoards is constantly growing at an exponential rate, particularly now that the excellent work undertaken as part of the Coin Hoards of the Roman Empire project at the Ashmolean Museum in Oxford is becoming available. As the sample size grows, the analyses provided by this thesis should be updated to reflect changes in modern knowledge. Only by constantly reviewing our position in light of the most up-to-date finds can any hoard study be considered robust and reliable.

To conclude, if there is some small value to be derived from this thesis beyond the dataset, the modelling and the conclusions provided above, it is hoped that it is in spurring debate on how the wealth of coin evidence available to modern scholars is best put to use. Material evidence provides our most immediate link to the past, and it is only by studying it in a comprehensive and considered way that we can begin to untangle the web of ancient economics.

Appendix: the hoards

Britain

Hoard	TPQ	Denarii	Antoniniani	Reference
Skellow	AD 82-83	262	0	Crawley, G. and Meadows, A. (1997) 'Skellow, Sou Yorkshire,' *CHRB X:* 54–61.
North Suffolk	AD 82-83	203	0	*Numismatic Chronicle* 170 (2010), 407-431.
Howe	AD 87	102	0	ASR 94
Anglesey	AD 87	32	0	ASR 96
Tamworth	AD 90	81	0	Bland, R. and Loriot, X. (2010) *Roman and Early Byzantine Gold Coins found in Britain and Ireland* (London: Royal Numismatic Society) 241-242.
Llanboidy	AD 90	24	0	Bolin 336
Corbridge	AD 98	31	0	ASR 111
Lavenham	AD 105	179	0	ASR 120
Northamptonshire	AD 103-111	19	0	Summary list provided by Professor K. Butcher.
Verulamium	AD 112-117	50	0	ASR 110
Baginton	AD 113	23	0	ASR 113
St. Albans	AD 118	48	0	ASR 145
Boston Spa	AD 119-122	173	0	ASR 154
Ormskirk	AD 119-122	118	0	ASR 135
Hastings	AD 119-122	58	0	ASR 139A
Thorngrafton	AD 119-122	61	0	ASR 137
Southants	AD 124-128	16	0	ASR 134
Middlewich	AD 125	30	0	Shotter, D. (2002) 'Middlewich, Cheshire,' *CHRB X* 61-63.
Swaby	AD 134-138	178	0	ASR 165
Waddington	AD 134-138	29	0	ASR 135A
Wakefield	AD 137	16	0	ASR 159
Chalfont St Giles	AD 145-146	23	0	ASR 213
Llanymynech	AD 148-149	33	0	ASR 212
Londonthorpe	AD 153-154	464	0	ASR 214
Snettisham	AD 155	83	0	ASR 202
Lawrence Weston	AD 156-157	595	0	ASR 215

East Stoke	AD 158-159	43	0	*Numismatic Chronicle* 156 (1996), 280-288.
Pyrford	AD 159-160	82	0	ASR 205
Osgodby	AD 163	44	0	Abdy, R., Johns, C. and Hill, J.D. (2002) 'Osgodby, Lincolnshire,' *CHRB XI*, 93-96
Long Whatton	AD 164	84	0	Abdy, R. (2002) 'Long Whatton, Leicestershire,' *CHRB XI*, 97-101
Hampstead Marshall	AD 169	83	0	Williams, J. and Read, C. (2002) 'Hampstead Marshall, Berkshire,' *CHRB XI,* 103-107
Brundish	AD 170-171	65	0	Bland, R. (1997) 'Brundish, Suffolk,' *CHRB X*, 104-1
Marlingford	AD 171-172	176	0	Bland, R., Davies, J. and Sheffield, C. (1997) 'Marlingford, Norfolk,' *CHRB X*, 104-114.
Potter's Bar	AD 175-176	95	0	Meadows, J., Orna-Ornstein, J., Williams, J. (1997 'Potters Bar, Hertfordshire', *CHRB X,* 116-120.
Aldworth	AD 176/177	40	0	ASR 284
Wreningham	AD 180	186	0	Davies, J. and Orna-Ornstein, J. (1997) 'Wreningham, Norfolk', *CHRB X,* 120-127.
Edwinstowe	AD 180	411	0	ASR 314
Barway	AD 180	464	0	ASR 228A
Bletchley	AD 187	924	0	ASR 319 and ASR 320
Knutsford	AD 190/191	101	0	https://finds.org.uk/database/hoards/record/id/2
Postwick	AD 192	275	0	ASR 330
Handley	AD 194-195	441	0	ASR 380
Silchester	AD 194-195	258	0	ASR 362
Great Melton	AD 195	268	0	Burnett, A.M. (1992) 'Great Melton, Norfolk (addenda),' *CHRB IX*, 47-56
Abergele	AD 201/206	343	0	ASR 383
Kenilworth	AD 207	52	0	Ireland, S., Wise, P.J. and Williams, J. (2002 'Kenilworth, Warwickshire (addenda),' *CHRB XI*, 8 90
Bottesford	AD 207	161	0	Williams, J. and Rigby, V. (2002) 'Bottesford, Nort Lincolnshire,' *CHRB XI*, 139-146
Bristol	AD 208	1476	0	ASR 385
Muswell Hill	AD 209	653	0	ASR 387
Holme	AD 209	405	0	*Numismatic Chronicle* 166 (2006) 365-373
Billingsgate	AD 210	140	0	ASR 386
Morton	AD 210	138	0	ASR 384
Much Hadham	AD 210-211	129	0	ASR 385A
Carrawburgh	AD 210-212	42	0	ASR 388

Darfield I	AD 213	500	0	ASR 394
Chadwell St Mary	AD 213/217	100	0	ASR 395
Prestwood A	AD 220	110	1	Abdy, R. (2002) 'Prestwood A, Buckinghamshire, *CHRB XI*, 163-168
Akenham	AD 220/222	59	0	ASR 403
Colchester	AD 223	3067	107	ASR 406
Shapwick	AD 224	9213	0	Abdy, R. and Minnitt, S. (2002) 'Shapwick Villa, Somerset,' *CHRB XI*, 169-233
Llanarmon	AD 226	504	3	ASR 426
St Mary Cray	AD 226	375	0	ASR 408
Darfield II	AD 235-238	480	1	ASR 431
Hartlebury	AD 240	56	0	ASR 437A
Standish	AD 240-244	97	1	ASR 442
Dereham	AD 241	1076	16	Self-compiled list from listing at https://www.dnw.co.uk/auction-archive/special collections/foreword.php?specialcollection_id=14 accessed 29/12/2019
Cambridge	AD 248	155	52	ASR 447
Elveden	AD 248	961	181	ASR 449
Lime Street	AD 249-251	318	271	ASR 460
Brickendon	AD 249-251	386	45	ASR 465
Edlington	AD 253-260	435	173	ASR 472
Burwell Farm	AD 253-260	56	23	ASR 471
Dorchester	AD 257	16	20732	ASR 470
Caister-on-Sea	AD 260	664	183	ASR 488
Mattishall	AD 260	758	325	ASR 489
Fineshade	AD 260	89	173	Curtis, M. (1997) 'Fineshade, Northamptonshire, *CHRB X*, 180-190
Stevenage	AD 263	384	2135	ASR 485
Crowmarsh	AD 266	24	312	King, C.E. (1997) 'Crowmarsh, Oxfordshire,' *CHRB* 87-104
Beachy Head 1964	AD 266	27	3139	ASR 492
Oliver's Orchard I	AD 269	14	1543	ASR 696
Bassaleg	AD 268	1	903	ASR 536A
Selsey	AD 270	9	966	ASR 550
Oliver's Orchard II	AD 270-275	3	4067	ASR 696
Oliver's Orchard III	AD 270-275	0	494	ASR 696

Boothstown	AD 270-275	0	540	ASR 698
Deeping St. James 1980	AD 270-275	11	2858	ASR 699
Throckley	AD 270-275	0	5024	ASR 702
Wickham Market	AD 270-275	0	1563	ASR 703
Beachy Head 1961	AD 270-275	0	5294	ASR 704
Beachy Head 1973	AD 270-275	0	5540	ASR 705
Aldbourne	AD 270-275	0	4541	ASR 706
Cadeby	AD 270-275	0	1635	ASR 708
Llanedeyrn	AD 270-275	0	1084	ASR 709
Cambridge	AD 270-275	0	2038	ASR 711
Upper Langwith	AD 270-275	0	1647	ASR 713
Poole	AD 270-275	0	964	ASR 715
Netley	AD 270-275	0	1812	ASR 719
Ancaster	AD 270-275	0	2159	ASR 722
Mildenhall	AD 270-275	1	1285	ASR 726
Doncaster	AD 270-275	0	1220	ASR 729
Wareham	AD 271	149	1412	Cheesman, C. and Bland, R. (1997) 'Wareham, Dorset,' *CHRB X*, 212-237
Emneth 1938	AD 271	0	1655	ASR 729
March	AD 271-274	0	816	ASR 557
East Mersea	AD 271-274	0	635	ASR 562
Deeping St. James 1967	AD 271-274	0	515	ASR 574
Meare Heath	AD 271-274	0	1404	ASR 584
Mytholmroyd	AD 271-274	0	597	ASR 592

Western Europe

Hoard	TPQ	Denarii	Antoniniani	Reference
Aubenton	AD 80/81	371	0	CTM 8/2 p.18-19. Summary list of denarii provided by Professor K. Butcher.
Herapel	AD 83	48	0	Franke, P.R., Leschborn, W. (1976) 'Denarfund flavischer Zeit vom Herapel/Lothringen', *Bericht der staatlichen Denkmalpflege im Saarland* 23: 67-72.
Casal Friume	AD 84	368	0	Centeno, R. (1987) *Circulação Monetária Noroeste Hispânia até 192*(Porto: Sociedad Portuguesa de Numismática) catalogue number 18.
Lugo	AD 89	28	0	Centeno, R. (1987) *Circulação Monetária Noroeste Hispânia até 192*(Porto: Sociedad Portuguesa de Numismática) catalogue number 49.
Otricoli	AD 90	47	0	Cesano, S.L. (1935) 'Ripostiglio monetale dell'età domiziana', *Notizie degli scavi di antichità* 1935: 366-380.
Pontevedra	AD 92	27	0	Centeno, R. (1987) *Circulação Monetária Noroeste Hispânia até 192*(Porto: Sociedad Portuguesa de Numismática) catalogue number 67.
Vilarnovo	AD 97	40	0	Centeno, R. (1987) *Circulação Monetária Noroeste Hispânia até 192*(Porto: Sociedad Portuguesa de Numismática) catalogue number 84.
Mozatella	AD 112	43	0	Cavedoni, C. (1842) 'Scavi di Lombardia', *Bollettino dell'istituto di correspondenza archeologica* 1-2: 15-16.
Gauting 1	AD 114/117	30	0	*FMRD* 1.1267
Montesiero	AD 115	107	0	Centeno, R. (1987) *Circulação Monetária Noroeste Hispânia até 192*(Porto: Sociedad Portuguesa de Numismática) catalogue number 58.
Eisenberg	AD 119/122	15	0	*FMRD* 4.2113.
Castagnaro	AD 119/122	1090	0	Rizzoli, L. (1914) 'Castagnaro (Verona) tesoretto monetale', *Rivista Italiana di Numismatica e Scienze Affini* 27: 349-364. The catalogue is unclear as to the number of each coin type in the hoard, so the list used is a reconstruction.
Gauting 2	AD 134/138	12	0	*FMRD* 1.1268.
Amiens XIII	AD 134/138	42	0	Fourcray, B. (1990) 'Amiens XIII: un trésor de deniers rue des Jacobins', *Trésors Monétaires* XII: 11.
Frankfurt	AD 139	280	0	*FMRD* 5.2280.
Kastell Zugmantel 3	AD 140/143	6	0	*FMRD* 5.1225
Samenheim	AD 148/149	20	0	*FMRD* 1.5063.

Stockstadt 2	AD 161/169	30	0	*FMRD* 1.6019.
Stockstadt 3	AD 164/169	1949	0	*FMRD* 1.6020.
Markobel 1	AD 168	44	0	*FMRD* 5.1044.
Bei Kelheim	AD 175/178	110	0	*FMRD* 1.2048.
Oberfeulen	AD 181/182	11	0	*FMRL* 1.127
Unterammergau	AD 184	106	0	*FMRD* 1.1102.
Barger-Compascuum	AD 187-188	305	0	*FMRN* 2.2006.
Breval	AD 193	122	0	*TAF* IX.6
Finkum	AD 194	13	0	*FMRN* 1.77
Kosching 1	AD 196/211	16	0	*FMRD* 1.1114
Flonheim	AD 198/200	300	0	*FMRD* 4.1023
Waldkirch	AD 200/201	18	0	*FMRD* 2.2062
Lliria III	AD 202/210	5987	0	Mira 4.117
Passewaaij	AD 205	27	0	*CHRE* 9991
Markobel 2	AD 206/210	69	0	*FMRD* 5.1045
Selingenstadt	AD 208	295	0	*FMRD* 5.2248
Castrillo de Cabrera	AD 211/217	53	0	Mira 2.94
Adige	AD 217	308	0	Arazone, A. (2001) 'Un ripostiglio di denari dall'alveo dell'Adige', in A. Saccocci (ed.), *Inspecto nummo. Scritti di numismatica, medaglistica e sfragistica offerti dagli allievi a Giovanni Gorini* 37-62.
Mainz III	AD 217/218	51	0	*FMRD* 4.1152
Baden-Baden 2	AD 218/222	15	2	*FMRD* 2.2197
Obererbach	AD 218/222	866	0	*FMRD* 4.5028
Hammermuhle	AD 218/222	31	1	*FMRD* 5.1271
Mainz IV	AD 222/228	186	0	*FMRD* 4.1153
Kempten-Lindenberg	AD 222/228	638	2	*FMRD* 1.7186
Pfunz	AD 222/235	93	0	*FMRD* 1.5042
Heidelberg-Neuenheim Kastellweg	AD 222/235	50	0	*FMRD* 2.1065
Baden-Baden 2	AD 222/235	372	6	*FMRD* 2.2196
Unterdigisheim	AD 222/235	30	2	*FMRD* 2.3027
Welzheim	AD 222/235	640	5	*FMRD* 2.4596
Sigmaringen	AD 228	44	0	*FMRD* N 2.3261/1
Eining 1	AD 228/231	47	0	*FMRD* 1.2034
Kempten-Spinnerei	AD 228/231	20	0	*FMRD* 1.7188
Munchen-Harlaching	AD 229/231	10	0	*FMRD* 1.1188
Kirchmatting	AD 231	1176	2	*FMRD* 1.2116

Marnbach	AD 231/235	161	2	*FMRD* 1.1325
Wiggensbach	AD 231/235	370	3	*FMRD* 1.7199
Langengeisling	AD 235/236	96	0	*FMRD* 1.1054
Niederaschau	AD 235/236	744	0	*FMRD* 1.1229
Marienfels	AD 235/236	120	0	*FMRD* 4.5008
Eining 2	AD 236	20	0	*FMRD* 1.2035
Kastell Zugmantel 1	AD 236	34	0	*FMRD* 5.1225
Koln Gertrudenstrasse	AD 236/238	3869	142	*FMRD* 6.1004.3a and 6.1004.3b
Rome - Via Tritone	AD 240	819	4	Lorenza, C. (1925) 'Nuovi ripostigli di denar di argento dell'impero romano,' *Annali dell'Istituto Italiano di Numismatica* 5, 52-74.
Ellignies-Saint-Anne	AD 240	274	0	Lallemand, J. (1968) 'Le trésor d'Ellignies-Sainte-Anne: deniers de Marc-Aurèle à Gordien III,' *Revue Belge de Numismatique* 138-168
Kosching 2	AD 241	237	3	*FMRD* 1.1115
Gunzenhausen	AD 241/243	305	2	*FMRD* 1.5057
Stellata	AD 242	570	46	Rizzoli, L. (1912) 'Tesoretto monetale rinvenuto a Stellata (Ferrara),' *Rivista Italiana di Numismatica e Scienze Affini,* 517-544
Mainz VI	AD 244/248	72	87	*FMRD* 4.1155
Castro de Oteruelo	AD 244/249	33	56	Mira 2.98
Kongen	AD 246/248	442	173	*FMRD* 2.4135/1 (N)
Mainz Kastell	AD 248/249	50	13	*FMRD* 4.1185
Ladenburg 1	AD 249/251	46	12	*FMRD* 2.1144
Ladenburg 2	AD 249/251	50	17	*FMRD* 2.1145
Kastell Zugmantel 2	AD 249/251	53	87	*FMRD* 5.1226
Evreux V	AD 249/251	0	176	*TAF* IV p.81
Niederlahnstein	AD 250	122	9	*FMRD* 4.5011
Bavay X	AD 251	19	31	*TAF* II p. 22
Weissenburg	AD 251/253	0	30	*FMRD* 1.5100
Burgau	AD 251/253	1	39	*FMRD* 1.7123
Wiesbach Mangelhausen	AD 251/253	258	144	*FMRD* 3.1082
Locquignol	AD 251/253	247	2	*TAF* II p.38
Cleres	AD 251/253	19	211	*TAF* IV p. 25
Sterrebeek	AD 253	1	357	Lallemand, J. (1960) 'Trésor d'antoniniens a Sterrebeek. Caracalla-Emilien,' *Revue Belge de Numismatique*, 21-60
Clavier III	AD 253	1085	584	Lallemand, J. (1969) 'Le trésor de Clavier III deniers et antoniniens de Commode à

				Valérien-Gallien,' *Revue Belge de Numismatique,* 263-331
Grosbous	AD 253/260	19	40	*FMRL* 1.154
Mettenbach	AD 255/256	0	28	*FMRD* 1.2075
Neuhofen	AD 257	0	351	*FMRD* 4.2219
Dalheim II	AD 257	35	24	*FMRL* 1.78
Laurensberg	AD 257/258	506	243	*FMRD* 6.2511
Lugo 2	AD 259	0	47	Mira 1.25
Olgishofen	AD 258/259	1	40	*FMRD* 1.7160
Eauze	AD 258/260	613	1025	Schaad, D. et al. (1992) *Le tresor d'Eauze* (Toulouse: Association pour la promotion du patrimoine archéologique et historique en Midi-Pyrénée)
Leimersheim	AD 259/260	10	350	*FMRD* 4.2069
Bondeno	AD 259/260	196	658	Calzolari, M. (1985) 'Tesoretto di monete romane d'argento dal territorio di Bondeno (Ferrara),' *Rivista Italiana di Numismatica e Scienze Affini,* 105
Pfakofen	AD 259/268	31	3	*FMRD* 1.3040
Regensburg	AD 259/268	2	116	*FMRD* 1.3081
Heidelberg-Neuenheim Keplerstrasse	AD 259/268	122	18	*FMRD* 2.1064
Mainz Erthalstrasse	AD 259/268	518	1298	*FMRD* 4.1164
Schwarzenacker	AD 260/268	2	4809	*FMRD* 3.1023
Altafulla	AD 260/268	0	227	Mira 1.47
S. Michele	AD 260/268	18	150	Pensa, M. (1984) 'Il tesoretto di S. Michele in Lodivecchio,' *Archivo Storico Lodigiano CIII*, 29-69
Mariakerke	AD 260/268	0	50	Brunin, M.G. (1908) 'Trouvaille de monnaie à Mariakerke-lez-Gand,' *Revue Belge de Numismatique*, 411
Ardres III	AD 260/268	2	667	*TAF* II p.61
Le Bourg D'hem	AD 260/269	1	193	*TAF* I p.86
Contern	AD 260/269	0	106	*FMRL* 1.72
Ettelbruck	AD 260/269	0	592	*FMRL* 1.123
Aubigny-au-Bac	AD 260/269	0	198	*TAF* II p.18
Allonnes i	AD 260/269	1	1015	*TAF* III p.19-20
Le Mans IV	AD 260/269	0	838	*TAF* III p.25
Dieppe (environs)	AD 260/269	0	160	*TAF* IV p.48
Anneville-Ambourville	AD 262	8	223	*TAF* IV p.20
Wallers II	AD 262/263	0	145	*TAF* II p. 45
Bingen	AD 263	47	29	*FMRD* 4.1059
Les Authieux	AD 263	0	295	*TAF* IV p.72

Howardries III	AD 264/265	0	242	Faider, Deytmans, G. (1960) 'Trésor d'antoniniens à Howardries: Elagabale-Postume,' *Revue Belge de Numismatique*, 61-80
Les Alqueries	AD 265	0	122	Mira 2.42
Almenara	AD 265/266	2	31	Mira 2.101
Falerone	AD 266	0	6927	Moretti, G. (1922)'Ripostigli monetale rinvenuto nell'area dell'antica Falerio,' *Notizie degli scavi di antichità,* 59-76.
Vareia	AD 266	0	182	Mira 1.45
Valhascos I	AD 266	0	461	Mira 3.002
Gibraltar	AD 266/267	1	29850	Mira 1.48
Famars	AD 267	0	251	*TAF* II p.33
Chantada	AD 267/268	0	49	Mira 1.29
Tarragona-1888	AD 267/268	0	105	Mira 1.49
Etaples V	AD 267/268	10	3823	*TAF* II p71
Jublains III	AD 267/268	0	821	*TAF* III p. 48
Eu	AD 268	0	996	*TAF* IV p.29
Harnes	AD 268	11	145	*TAF* II p.74
Bavay IX	AD 268	0	512	*TAF* II p. 22
Alzey	AD 268	6	373	*FMRD* 4.1005
Thulin II	AD 268	1	697	De Bove, M. (1880) 'Noticesur un dépôt de monnaies gallo-romaines trouvé à Thulin,' *Revue Belge de Numismatique*, 66-82
Grotenberge	AD 268	0	2381	Naster, P. (1951) 'La trouvaille d'antoniniar de Grotenberge et le monnayage de Postume,' *Revue Belge de Numismatique*, 61-80
Schneppenbach	AD 268/270	2	807	*FMRD* 4.1495/2 (N)
Aldeia des Dez	AD 268/270	0	270	Mira 1.61
Valsadornin	AD 268/270	0	2421	Mira 1.60
Montecalvo Versiggia	AD 268/270	0	357	Patroni, G. (1924) 'Tesoretto di antoninian scoperto nella frazione Michelazza' *Notizie degli scavi di antichità,* 278
Andenne	AD 268/270	0	265	Thirion, M. (1963) 'Trésor d'antoniniens à Andenne: Philippe I à Victorin-Claude II,' *Revue Belge de Numismatique*, 175-189
Dreiterpen	AD 268/270	0	62	*FMRN* 1.54
Malicorne	AD 269/270	0	1050	Girard, J-P. (1966) 'Malicorne et Bonneuil-sur-Marne: deux trésors monétaires du temps de Victorin,' *Revue Numismatique,* 144-180
Bonneuil-sur-Marne	AD 269/270	0	1759	Girard, J-P. (1966) 'Malicorne et Bonneuil-sur-Marne: deux trésors monétaires du temps de Victorin,' *Revue Numismatique,* 144-180

Tourouvre I	AD 269/271	0	130	Guihard, P-M (2010) 'Le tresor double de Tourouvre (Orne). Bijoux et monnaies de Domitien a Victorin,' *Jahrbuch des Romisch Germanischen Zentralmuseums Mainz*, 151 220
Tourouvre II	AD 269/271	83	193	Guihard, P-M (2010) 'Le tresor double de Tourouvre (Orne). Bijoux et monnaies de Domitien a Victorin,' *Jahrbuch des Romisch Germanischen Zentralmuseums Mainz*, 151 220
Pruille-le-Chetif	AD 269/271	0	1219	*TAF* III p.28
Talmont-Saint-Hilaire	AD 269/271	0	7426	*TAF* III p.114
Treffieux	AD 269/271	0	909	*TAF* III p.89
Feilbingert	AD 270	0	102	*FMRD* 4.2296
Orscholz	AD 270	0	2773	*FMRD* 3.1044
Son Hereu 1	AD 270	0	102	Mira 1.65
Sao Cucufate II	AD 270	0	122	Mira 2.105
Salperwick	AD 270/271	0	1452	*TAF* II p.81
Battenberg	AD 270/274	0	117	*FMRD* 4.2022
Huttersdorf	AD 270/274	0	726	*FMRD* 3.1134
La Flotte-en-Re	AD 270/274	0	793	*TAF* I p.47
Melle	AD 270/275	0	751	*TAF* I p.35
Forchheim	AD 270/275	0	285	*FMRD* 4.4016
Steinfort	AD 270/275	0	2120	*FMRL* V.131
Tetelbierg II	AD 270/275	0	57	*FMRL* 2.201
Warlencourt-Eaucourt	AD 270/275	0	1942	*TAF* II p.85
Allonnes II	AD 270/275	0	3085	*TAF* III p.20
Beaufay	AD 270/275	0	8117	*TAF* III p.21
Beaumont-Pied-De-Boeuf	AD 270/275	0	2386	*TAF* III p.45
Etivals-les-Le-Mans	AD 270/275	9	3052	*TAF* III p.23
Haute-Goulaine	AD 270/275	0	1456	*TAF* III p.85
Jublains I	AD 270/275	0	4504	*TAF* III p.47
Reze	AD 270/275	0	123	*TAF* III p.87
Caudebec-les-Elbeuf III	AD 270/275	0	1038	*TAF* IV p.25
Niederingelheim	AD 270/280	0	1173	*FMRD* 4.1092
Arona	AD 271	0	2813	Bosco, E. (1912) 'Ripostiglio di monete Romane,' *Rivista Italiana di Numismatica e Scienze Affini* 25, 455
Totes	AD 271	4	1393	*TAF* IV p.46
Septfontaines	AD 271/273	0	23	*FMRL* 1.321
Kahler	AD 271/273	0	28	*FMRL* 1.190

Kleinbettingen	AD 271/273	0	97	*FMRL* 1.145
Burmerange	AD 271/273	0	318	*FMRL* 1.57
Driesum	AD 271/273	0	92	*FMRN* 1.51
Brauweiler	AD 274	0	2623	Ziegler, R. (1983) *Der Schatzfund von Brauweiler. Untersuchungen zur Münzprägung und zum Geldumlauf im gallischen Sonderreich* (Cologne: Rheinland Verlag GmbH)

Eastern Europe

Hoard	TPQ	Denarii	Antoniniani	Reference
Acarnania	AD 97	42	0	*CH* IV 108
Medves	AD 112/117	140	0	Moisil, D. and Depeyrot, G. (2003) *Les trésors de deniers antérieurs à Trajan en Roumanie* (Moneta 33) (Wetteren: Moneta) no.210.
Ilisua	AD 117/138	33	0	Moisil, D. and Depeyrot, G. (2008*) Les trésors de deniers et d'antoniniens de Gordien III à Aurélien en Roumanie* (Moneta 78) (Wetteren: Moneta) no.13
Gyor	AD 134/138	363	0	*FMRU* 2 p.84-92.
Erla	AD 138	659	0	Jungwirth, H. (1967) 'Der Münzschatzfund von Erla', Numismatische *Zeitschrift* 82, 26–48
Dimbau	AD 140/143	135	0	Preda, C. (1957) 'Tezaurul monetar de la Dîmbău (reg. Stalin) şi tulburările pricinuite de Daci în anul 143, sub Antonin Piul,' Studii *şi cercetări de numismatică*, 113-131
Covasint	AD 141/161	168	0	Mihailescu-Birliba, V. (1980) La *monnaie romaine chez les Daces orientaux* (Bucharest: Editura Academiei Republic Socialiste România) 115.
Slovenj Gradec	AD 145/161	63	0	*FMRS* 1.226/3
Salasuri	AD 149/152	2990	0	Molnár, I. and Winkler, I. (1965) 'Tezaurul de monete romane de la Sălaşuri,' Acta *Musei Napocensis*, 269-294
Vyskovce	AD 151/152	1058	0	Ondruch, V. (1934) Der *römische Denarfund von Vyškovce aus der Frühkaiserzeit* (Bratislava: Učená Společnost Šafaříkova)
Barbura	AD 161/176	80	0	Pal, K. (1915) 'Eremleletek,' Numizmatikai Közlöny, 70.
Draghiceni	AD 164/180	455	0	Chitu, S. (1971) 'Tezaurul monetar roma de la Drăghiceni,' Revista *Muzeelor*, 261
Gostavat II	AD 164/180	324	0	Popilian, G. (1971) 'Descoperirea monetară de la Gostavăţ (jud. Olt),' *Historica*, 35-53.
Mocsolad	AD 164/165	1227	0	Gohl, O. (1905) 'A mocsoládi éremlelet, Numizmatikai *Közlöny*, 75-78.
Kurd Gyulaji	AD 164/165	1120	0	Merey, A. (1936) 'Kurd-gyulaji római éremlelet,' Numizmatikai *Közlöny*, 77-78
Sotin	AD 165/166	1936	0	Mirnik, A. (1981) *Coin Hoards in Yugoslavia* (Oxford: British Archaeological Reports) no.57.

Apetlon II	AD 166/167	137	0	*FMRO* I/2 293-295
Carnuntum III	AD 168/169	123	0	Dembski, G. (1977) 'Die antiken Münzschatzfunde aus Österreich,' Numismatische *Zeitschrift*, 3-64
Simoniesti	AD 177/178	101	0	*Studii şi cercetări de numismatică* (1968 385-391.
Garla Mare	AD 179/180	320	0	Preda, C. (1974) 'Tezaurul monetar din epica romană descoperit la Gârla Mare (Jud. Mehedinţi),' *Historica*, 67-91.
Prelasko	AD 180-193	578	0	*FMRS* 2.353.
Dumbravioara	AD 180/183	299	0	Gazdac, C. (1994) 'Le trésor monétaire impérial de Dumbrăvioara (Reghin II) réétudié,' Ephemeris *Napocensis*, 179-191.
Butoiesti	AD 180	167	0	Popilian, G. and Stan-Mircesti, I. (1989) 'Tezaurul de monede romane imperiale de la Butoieşti (judeţul Mehedinţi),' Studii *şi cercetări de numismatică*, 37-4
Balanesti II	AD 181	103	0	Mihailescu-Birliba, V. (1980) *La monnai romaine chez les Daces orientaux* (Bucharest: Editura Academiei Republic Socialiste România) 22.
Bela Reka	AD 182	322	0	Mirnik, A. (1981) *Coin Hoards in Yugoslavia* (Oxford: British Archaeological Reports) no.53.
Alba Iulia I	AD 184/185	610	0	Gazdac, C. (1996) 'Il tesoro monetale romano imperiale Apulum I. Nuovo Ricerche,' *Ephemeris Napocensis*,135-152
Lucieni	AD 193	79	0	Depeyrot 146
Szombathely II	AD 193/196	58	0	Czeglédy, I. (1962) 'Császárkori denárlelet Szombathelyröl,' *Numizmatikai Közlöny*, 15-22
Lujerdiu	AD 194/195	278	0	Ionescu, C. (1997) 'Le trésor de monnaie romaines impériales de Lujerdiu (dép. D Cluj) – Réétudié,' *Ephemeris Napocensis* 129-165
Ghirisa I	AD 197/198	151	0	Depeyrot 141
Sarmizegetusa II	AD 201/206	22	0	*CHRE* 2616
Mor-Felsodobosrol	AD 203	65	0	Fitz, J. (1960) 'Septimius Severus-kori dénárlelet Mór-Felsödobosról,' Numizmatikai Közlöny, 16-22
Virunum	AD 208	20	0	*dFMRO*
Cortanovci	AD 210	2459	0	Vojvoda, M. (2011) 'A hoard of Roman coins from Cortanovci in Srem,' *Numizmaticar*, 9-282.

Rebelcja	AD 216	11	0	*FMRSI* 2.434.19
Vindobona IV	AD 218/222	98	0	*FMRO* IX 787-907
Francesti	AD 219	1365	0	Depeyrot 166
Barza (Danesti)	AD 222/228	1336	0	Depeyrot 174
Camplung-Muscel	AD 222/235	44	0	Depeyrot 175
Ptuj	AD 222/235	66	0	*FMRSI* 2.434.13
Nires	AD 227	29	0	Depeyrot 184
Turda II	AD 228/231	36	0	Depeyrot 191
Tisa	AD 229	850	0	Depeyrot 189
Ercsi	AD 231	272	1	Borić-Brešković, B. and Vojvoda, M. (2012) 'Hoard of Roman silver coins fror the village of Mehovine near Šabac,' *Numizmaticar*, 21-113.
Deleu	AD 231/235	1250	9	Gazdac, C., Alfoldy-Gazdac, A., Cocis, C. and Calian, L. (2010) *The Roman Imperia hoard "Deleu" from Cluj-Napoca* (Cluj-Napoca: Mega Publishing House)
Borgond	AD 232	316	0	Depeyrot 174
Leskovec	AD 235/236	122	0	*FMRSI* 408
Csapon	AD 235/238	101	4	Gohl, O. (1914) 'A csapói éremlelet,' Numizmatikai *Közlöny*, 70
Mehovine	AD 236/238	465	2	Mirnik, A. (1981) *Coin Hoards in Yugoslavia* (Oxford: British Archaeological Reports) no.66.
Postojna	AD 236/238	339	0	*FMRSI* 91.2
Supska II	AD 236/238	927	2	Borić-Brešković, B. and M. Vojvoda (2013) 'A hoard of Roman silver coins from the village of Supska near Ćuprija (Supska II),' *Numizmaticar,* 9-153
Dragasani	AD 238/239	149	6	Popilian, G. and Persu, E. (2002) 'Tezaurul de monede romane imperiale de la Drăgăşani,' Buletinul *Societăţii Numismatice Române*, 45-54
Taga	AD 238/239	1004	8	Depeyrot 25
Vartop	AD 241	51	2	Depeyrot 27
Dobridor	AD 241/243	28	0	Depeyrot 11
Mangalia IV	AD 241/243	42	1	Depeyrot 16
Potaissa	AD 242/243	106	105	Winkler, I. and Hopârtean, A. (1973) *Moneda antică la Potaissa* (Cluj: Muzeu de Istorie Turda)

Murzzuschlag	AD 243	117	21	*dFMRO*
Balesti	AD 243/244	292	64	Depeyrot 5
Critesti I	AD 243/244	110	9	Depeyrot 9
Sapata de Jos	AD 243/244	16	28	Depeyrot 22
Alba Iulia V	AD 244/246	132	26	Depeyrot 29
Barca III	AD 244/246	1940	40	Depeyrot 32
Jiet-Popi	AD 244/246	45	29	Depeyrot 50
Galicia Mare	AD 244/247	497	303	Depeyrot 43
Ionesti Govorii	AD 244/247	0	151	Depeyrot 49
Motatei II	AD 244/247	79	1	Depeyrot 53
Ocolna	AD 244/247	92	8	Depeyrot 55
Timisoara	AD 244/247	48	18	Depeyrot 63
Bakonyszombathely	AD 246/247	635	32	FMRU III 62-79
Canlia	AD 246/248	229	260	Depeyrot 38
Rusi	AD 246/248	49	89	Depeyrot 58
Slaveni II	AD 246/248	0	166	Depeyrot 61
Slaveni I	AD 247/249	5	104	Depeyrot 60
Visuia	AD 247/249	626	168	Depeyrot 67
Plevna	AD 249/251	594	2704	Mattingly, H. and Salisbury, F. S. (1924) 'A Find of Roman Coins from Plevna in Bulgaria,' *Numismatic Chronicle*, 210-23
Pilisszanto	AD 249/251	0	115	Biró-Sey, K. (1966) 'A Pilisszántói éremlelet,' *Numizmatikai Közlöny*, 9-11
Bosca Romana	AD 249/251	27	89	Depeyrot 70
Leurda	AD 249/251	17	9	Depeyrot 72
Moigrad I	AD 249/251	9	12	Depeyrot 75
Barca I	AD 249/251	34	33	Depeyrot 68
Barca IV	AD 250/251	40	87	Depeyrot 69

Abrud	AD 251/252	1846	209	Depeyrot 77
Apoldul de Jos	AD 251/253	187	7	Depeyrot 78
Moigrad II	AD 251/253	6	35	Depeyrot 81
Raureni	AD 251/253	2	24	Depeyrot 83
Stramptu	AD 251/253	34	62	Depeyrot 86
Pelifoldszentkereszt	AD 251/253	106	71	*FMRU* III 57-61
Budaors	AD 251/253	409	1820	Kaba, M. (1984) 'III. Századi éremlelet Budaörsröl, 'Numizmatikai *Közlöny*, 7-1
Vajdahunyad	AD 251/253	974	8	Gohl, O. (1906) 'Vajdahunyad,' Numizmatikai *Közlöny*, 137-139
Korong	AD 253	0	932	*CHRE* 5344
Adriach	AD 253/254	73	215	*dFMRO*
Beltinci	AD 253/259	0	28	*FMRSl* 459
Szakcs	AD 253/259	0	872	Kerekes, P. (1914) 'A szakcsi római éremlelet, 'Numizmatikai *Közlöny*, 145-146
Kab-hegy	AD 253/259	3	138	Kubitschek, W. (1903) 'Ein Münzenfund aus Südwestungarn,' *Jahreshefte des Österreichischen Archäologischen VI*, 107-110
Nagyberki I	AD 253/259	13	37	Biro-Sey, K. (1972) 'Néhány III. Századi éremlelet értékelése és ennek problémái,' Numizmatikai *Közlöny*, 3-12
Ostra Luka I	AD 254	1	186	Gazdac 521
Stanesti	AD 254/255	501	282	Istrate Purece, S. (2005) *Tezaurul de la Stăneşti* (Bucharest: Economica)
Tac	AD 254/259	32	647	*FMRU* 1 289-327.
Balozsameggyes	AD 255	272	65	Bíró-Sey, K., Károlyi, M. and Szentlékeky T. (1971) 'A Balozsameggyesi Római Èkszer-Ès Èremlelet,' *Archaeologiai Értesítő*, 190-204
Olteni	AD 257	112	150	Depeyrot 90
Lager IV	AD 257	0	49	*dFMRO*
Krainsche Honle	AD 257/258	1	11	*FMRSl* 467.2
Nagyvenyim	AD 257/258	2	1231	Fitz, J. (1990) 'Antoninianus éremlelet Nagyvenyimböl,' *Numizmatikai Közlöny* 13-39
Kistormas	AD 258	91	718	Biro-Sey, K. (1963) 'A kistormási éremlelet / Le trésor de monnaies

				romaines de Kistormás,' Folia Archaeologia, 55-68
Otrovanec	AD 258	0	352	Gazdac 504
Garcin II	AD 258	0	52	Gazdac 524
Zalaszengrot	AD 258/259	5	35	Torbágyi, M. (1997) 'Zalaszentgróti antoninianus lelet,' Z*alai Múzeum*, 105-114
Dunaujvaros I	AD 258/259	1	227	Alfoldi, M.R. (1954) 'A sztálinvaráros-(Dunapentele)-dunadülöi éremlelet 'Numizmatikai *Közlöny,* 5-8
Diosig	AD 258/259	0	65	Depeyrot 89
Petronell	AD 258/259	0	54	Gazdac 504
Felsotengelic	AD 259	12	1076	Albeker, M. and Biro-Sey, K. (1970) 'Antoninianus lelet felsötengelicröl,' *Numizmatikai Közlöny*, 13-23
Szalacska IV	AD 259	14	900	Alfoldi, M.R. (1952) 'An IV. Szalacskai éremlelet,' *Numizmatikai Közlöny,* 7-19
Trnje	AD 259/260	0	29	*FMRSI* 462
Krog	AD 259/260	123	2162	*FMRSI* 466
Apetlon I	AD 260	3	358	*dFMRO*
Repusnica	AD 260	0	126	Gazdac 506-7
Alba Iulia IV	AD 260/268	17	1188	Depeyrot 94
Alba Iulia VII	AD 260/268	55	814	Depeyrot 95
Preg	AD 262	0	29	*dFRMO*
Maradik	AD 263	0	247	Gazdac 527
Alba Iulia II	AD 265/268	24	77	Depeyrot 93
Dvor	AD 267/268	0	322	*FMRSI* 213
Oberdorf	AD 267/268	18	8	*dFMRO*
Isaccea	AD 268	4	1064	Preda, C. and Simion, G. (1971) 'Tezaur de monede romane imperiale descoper la Isaccea şi atacul gotic din vremea lui Gallienus,' *Peuce* II, 167-177
Obudovac	AD 268	0	786	Gazdac 528
Nagyberki II	AD 268/270	69	2491	Gohl, O. (1913) 'A nagyberki római éremlelet,' *Numizmatikai Közlöny*, 104-108
Baldersdorf	AD 270/275	0	1214	*dFMRO*
Klagenfurt	AD 270/275	0	162	*FMRO* II.3 81-242

The East and North Africa

Hoard	TPQ	Denarii	Antoniniani	Reference
Sakha	AD 114/117	262	0	Weber, S.H, (1932) 'An Egyptian Coin Hoard of the Second Century A.D.,' ANS *Numismatic notes & monographs*
Volubilis	AD 119/122	105	0	Salama, P. and Besombes, P-A (2002) 'L trésor de deniers d'Ain-Temouchent et ses "satellites" dans l'Afrique romaine', *Trésors Monétaires* XX: 190.
Murabba'at	AD 119/122	51	0	Milik, J. T. and Seyrig, H. (1958) 'Le trésc monétaire de Murabba'ât,' Revue Numismatique, 11-26
Eleutheropolis	AD 134/138	170	0	Noe, S.P. (1937) *A Bibliography of Greel Coin Hoards* (New York: American Numismatic Society) 108
Hebron District	AD 135	38	0	Meshorer, Y. (1985) 'A Coin Hoard of Bar-Kokhba's Time,' *The Israel Museum Journal*, 43-50
Tipasa I	AD 143	84	0	Salama, P. and Besombes, P-A (2002) 'L trésor de deniers d'Ain-Temouchent et ses "satellites" dans l'Afrique romaine', *Trésors Monétaires* XX: 191.
Larnaka	AD 183/184	441	0	Metcalf, W.E. (1979) 'A Roman hoard from Cyprus,' *Numismatic Chronicle*, 26 35
Sabratha baths	AD 200-205	26	0	CHRE 4965
Nineveh	AD 209-211	142	0	Hill, G.F. (1931) 'A hoard of coins from Nineveh,' *Numismatic Chronicle,* 160-170.
Announa	AD 210	480	0	Salama, P. and Besombes, P-A (2002) 'L trésor de deniers d'Ain-Temouchent et ses "satellites" dans l'Afrique romaine', *Trésors Monétaires* XX: 192.
Syria	AD 213-217	261	0	*CHRE* 5332
Ain Temouchent	AD 215	287	0	Salama, P. and Besombes, P-A (2002) 'L trésor de deniers d'Ain-Temouchent et ses "satellites" dans l'Afrique romaine', *Trésors Monétaires* XX: 185-222.
Dura 3	AD 218	224	0	Depeyrot, G. (n.d.) 'Coins from Excavations at Dura-Europos,' working paper, published https://www.academia.edu/40703968/ OINS_FROM_EXCAVATIONS_AT_DURA- EUROPOS_REORGANIZED_LIST_OF_COI _FINDS, accessed 30/12/2019
Dura 4	AD 218	153	0	Depeyrot, G. (n.d.) 'Coins from Excavations at Dura-Europos,' working paper, published https://www.academia.edu/40703968/

				OINS_FROM_EXCAVATIONS_AT_DURA-EUROPOS_REORGANIZED_LIST_OF_COI _FINDS, accessed 30/12/2019
Tell Kalak	AD 222	1983	0	Metcalf, W. (1975) *The Tell Kalak Hoard and Trajan's Arabian Mint* (New York: American Numismatic Society)
Sulakyurt	AD 235-237	428	0	*CHRE* 3120
Gush Halav	AD 244-249	22	0	Hamburger, H. (1954) 'A hoard of Syrian tetradrachms and Tyrian bronze coins from Gush Halav,' *Israel Exploration Journal*, 201-226.
Dura Europos 7	AD 251-253	66	75	Depeyrot, G. (n.d.) 'Coins from Excavations at Dura-Europos,' working paper, published https://www.academia.edu/40703968/ OINS_FROM_EXCAVATIONS_AT_DURA-EUROPOS_REORGANIZED_LIST_OF_COI _FINDS, accessed 30/12/2019
Smyrna II	AD 253-258	1	1242	*CHRE* 3438
Dura Europos 10	AD 256	0	151	Depeyrot, G. (n.d.) 'Coins from Excavations at Dura-Europos,' working paper, published https://www.academia.edu/40703968/ OINS_FROM_EXCAVATIONS_AT_DURA-EUROPOS_REORGANIZED_LIST_OF_COI _FINDS, accessed 30/12/2019
Pergamum	AD 258-259	11	446	*CHRE* 3383
Haydere	AD 264	1099	1196	*CHRE* 3711
Iasos	AD 267	11	2986	Tondo, L. (2003) 'Il tesoro dell'agorà di Iasos. Un archivio d'argento dell'epoca d Plotino,' *Bollettino di numismatica*, 29-262.

Bibliography

Primary sources

Cassius Dio, *Historiae Romanae*.

Suetonius, *The Lives of the Twelve Caesars: Nero*.

Tacitus, *Annals*.

Tacitus, *Histories.*

Pliny the Elder, *Historia Naturalis*.

Secondary sources

Aarts, J.(2005) 'Coins, money and exchange in the Roman world. A cultural-economic perspective'. *Archaeological Dialogues* 12: 1–28.

Abdy, R.(2002) *Romano-British Coin Hoards*. (Princes Risborough: Shire Archaeology).

Aitchison, N. B.(1988) 'Roman wealth, native ritual: coin hoards within and beyond Roman Britain'. *World Archaeology* 20 (2): 270–84. http://www.scopus.com/inward/record.url?eid=2-s2.0-0024161662&partnerID=40&md5=aaaa3d5db46af090b189f9b29bc94005

Akerman, J. Y.(1834) *A Descriptive Catalogue of Rare and Unedited Roman Coins, from the Earliest Period of the Roman Coinage to the Extinction of the Empire under Constantinus Paleologos*. (London: Effingham Wilson).

Alföldy, G.(1974) 'The Crisis of the Third Century as Seen by Contemporaries'. *Greek, Roman and Byzantine Studies* 15 (1): 89–111.

Allason-Jones, L. and McKay, B.(1985) *Coventina's Well: a shrine on Hadrian's Wall*. (Chollerford, Hexham, Hexham: Trustees of the Clayton Collection, Chesters Museum).

Alston, R.(1994) 'Roman Military Pay from Caesar to Diocletian'. *The Journal of Roman Studies* 84: 113–23.

Bagnall, R. S.(1996) *Egypt in late antiquity*. (Princeton: Princeton University Press).

Balch, T. W.(1908) 'The law of Oresme, Copernicus and Gresham'. *Proceedings of the Americal Philosophical Society* 47 (188): 18–29.

Berger, F.(1996) 'Roman coins beyond the northern frontiers: some recent considerations'. in *Coin finds and coin use in the Roman world. The thirteenth Oxford symposium on coinage and monetary history, 25-27.03.1993*. (Berlin: Gebr. Mann).

Blanchet, A.(1900) *Les trésors de monnaies romaines et les invasions germaniques en Gaule*. (Paris: E. Leroux).

Bland, R.(1996) 'The development of gold and silver coin denominations, A.D. 193-253'. in C. E. King and D. G. Wigg (eds.). *Coin finds and coin use in the Roman world. The thirteenth Oxford symposium on coinage and monetary history, 25-27.03.1993*. (Berlin: Gebr. Mann), pp. 63–100.

———(2013a) 'Hoarding in Britain: an overview'. *British Numismatic Journal* 83: 46–70.

———(2013b) 'What happened to gold coinage in the 3rd c. A.D.?' *Journal of Roman*

Archaeology 26: 263–80. http://www.journals.cambridge.org/abstract_S1047759413000159

——— and Abdy, R.(2002) 'Hoards of the Severan period from Britain'. in R. Abdy, I. Leins, and J. Williams (eds.). *Coin hoards from Roman Britain Vol. XI*. (London: Royal Numismatic Society), pp. 19–45.

Bolin, S.(1958) *State and currency in the Roman empire up to 300 AD*. (Stockholm: Almqvist & Wiksell).

Bradley, R.(1998) *The Passage of Arms. An Archaeological Analysis of Prehistoric Hoard and Votive Deposits*. 2nd Ed. (Oxford: Oxbow Books).

Bransbourg, G.(2011) 'Fides et Pecunia Numerata: Chartalism and Metallism in the Roman World. Part 1 : The Republic'. *American Journal of Numismatics* 23: 87–152.

Bruun, P.(1978) 'Site finds and hoarding behaviour'. in R. A. G. Carson and C. M. Kraay (eds.). *Scripta nummaria Romana: essays presented to Humphrey Sutherland*. (London: Spink and Sons), pp. 114–23.

Budé, G.(1514) *De asse et partibus eius*. (Paris: Badius Ascensius).

Burnett, A.(1980) 'Review of: The Metrology of the Roman Silver Coinage. Parts I-III (British Archaeological Reports, Supplementary Series, nos . 5 , 22, and 40) by D . R . Walker'. *The Numismatic Chronicle* 20: 214–7.

Bursche, A.(1986) 'Contacts between the Roman Empire and the mid-European barbaricum in the light of coin finds'. in I. A. Carradice (ed.). *Proceedings of the 10th International Congress of Numismatics*. (London: International Association of Professional Numismatists), pp. 279–87.

———(1991) 'Pourquoi les denarii frappés après 194 étaient-ils absent dans le Barbaricum?' in *Proceedings of the XIth International Numismatic Congress Brussels 1991. Vol. II*. (Louvain-la-Neuve: Association Professeur Marcel Hoc), pp. 297–303.

———(1996) *Later Roman - Barbarian Contacts in Central Europe: Numismatic Evidence*. (Berlin: Gebr. Mann).

———(2008) 'Inflation and influx of Roman coins into barbaricum'. in M. Asolati and G. Gorini (eds.). *I ritrovamenti monetali e i processi inflativi nel mondo antico e medievale: Atti del IV Congresso Internazionale di Numismatica e di Storia Monetaria, Padova, 12-13 ottobre 2007*. (Padua: Esedra), pp. 53–62.

Butcher, K.(2013) 'Coins and Hoards'. in W. Aylward (ed.). *Excavations at Zeugma conducted by Oxford Archaeology. Volume III*. (Los Altos, California: The Packard Humanities Institute), pp. 1–92.

———(2018) 'Monetary policy in the Roman Empire'. in R. J. van der Spek and B. van Leeuwen (eds.). *Money, Currency and Crisis: In Search of Trust, 2000 BC to AD 2000*. (London: Routledge), pp. 165–84.

——— and Ponting, M.(1995) 'Rome and the East: production of Roman provincial silver coinage for Caesarea in Cappadocia under Vespasian'. *Oxford Journal of Archaeology* 14 (1): 63–77.

——— and ———(1998) 'Atomic absorption spectrometry and Roman silver coins'. in A. Oddy and M. Cowell (eds.). *Metallurgy in numismatics,Vol. 4*. (London: The Royal Numismatic Society), pp. 308–34.

——— and ———(2005) ‘The Roman denarius under the Julio-Claudian emperors: mints, metallurgy and technology’. *Oxford Journal of Archaeology* 24 (2): 163–97.

——— and ———(2009) ‘The Silver Coinage of Roman Syria Under the Julio- Claudian Emperors’. *Levant* 41 (1): 59–78.

——— and ———(2012) ‘The beginning of the end? The denarius in the second century’. *The Numismatic Chronicle* 172: 63–83.

——— and ———(2015) *The metallurgy of the Roman silver coinage from the reforms of Nero to the reforms of Trajan*. (Cambridge: Cambridge University Press).

——— and ———(2016) ‘The reforms of Trajan and the end of the pre-Neronian denarius’. *Annali del istituto Italiano di numismatica* 61: 21–43.

———, ——— and Chandler, G.(1997) ‘A study of the chemical composition of Roman silver coinage, AD 196-197’. *American Journal of Numismatics* 9: 17–36.

Buttrey, T. V.(1961a) ‘Dio, Zonaras and the value of the Roman aureus’. *The Journal of Roman Studies* 51: 40–5.

———(1961b) ‘Review of: State and Currency in the Roman Empire to 300 A . D . by Sture Bolin’. *American Journal of Archaeology* 65 (1): 84–7.

———(1993) ‘Calculating ancient coin production: facts and fantasies’. *The Numismatic Chronicle* 153: 335–51.

———(1994) ‘Calculating ancient coin production II: why it cannot be done’. *The Numismatic Chronicle* 154: 341–52.

Buttrey, S. E. and Buttrey, T. V.(1997) ‘Calculating ancient coin production, again’. *American Journal of Numismatics* 9: 113–35.

Caley, E. R.(1926) ‘The Leyden Papyrus X: An English translation with brief notes’. *Journal of Chemical Education* 3 (10): 1149–66.

———(1964) *Analysis of ancient metals*. (London: Pergamon).

Cameron, A.(1993) *The later Roman empire*. (London: Fontana Press).

Carradice, I. A.(1983) *Coinage and finances in the reign of Domitian*. (Oxford: British Archaeological Reports).

——— and Buttrey, T. V.(2007) *The Roman Imperial Coinage: Vol. 2 Part 1, from AD 69-96 Vespasian to Domitian*. 2nd Ed. (London: Spink and Sons).

Carson, R. A. G.(1965) ‘The reform of Aurelian’. *Revue numismatique* 7: 225–35.

Carter, G. F.(1964) ‘Preparation of ancient coins for accurate x-ray fluorescence analysis’. *Archaeometry* 7: 106–13.

Casson, L.(1990) ‘New light on maritime loans: P. Vindob. G 40822’. *Zeitschrift für Papyrologie und Epigraphik* 84: 195–206.

Chown, J. F.(1994) *A History of Money: From AD 800*. (Oxford: Routledge).

Christiansen, E.(2004) *Coinage in Roman Egypt: the hoard evidence*. (Aarhus: Aarhus University Press).

Comparette, T. L.(1913) ‘Debasement of the silver coinage under the emperor Nero’.

American Journal of Numismatics 47: 131–41.

Condamin, J., Guey, J. and Picon, M.(1965) 'Techniques romaines [Exemplaires cisaillés avant la frappe. Exemplaires frappés à froid.]'. *Revue numismatique* 7: 123–33.

———, ——— and ———(1967) 'Métallurgie des monnaies antiques [Problèmes anciens et nouveaux à la lumière des récentes recherches de laboratoire de Lyon.]'. *Revue numismatique* 9: 265–8.

———, ——— and ———(1973) 'Dosage d'oxygène par activation neutronique dans un lot de quatorze tetradrachmes alexandrins'. *Bulletin de la Société Française de Numismatique* 28: 343–5.

——— and Picon, M.(1964) 'The Influence of Corrosion and Diffusion on the Percentage of Silver in Roman Denarii'. *Archaeometry* 7 (1): 98–105.

——— and ———(1965) 'Notes on diffusion in ancient alloys'. *Archaeometry* 8: 110–4.

——— and ———(1972) 'Changes suffered by coins in the course of time and the influence of these on the results of different methods of analysis'. in E. T. Hall and D. M. Metcalf (eds.). *Methods of Chemical and Metallurgical Investigation of Ancient Coinage*. (London: Royal Numismatic Society), pp. 46–66.

Cope, L. H.(1967) 'Roman imperial silver coinage alloy standards: the evidence'. *The Numismatic Chronicle* 7: 107–31.

———(1969) 'The nadir of the imperial antoninianus in the reign of Claudius II Gothicus. AD 268-270'. *The Numismatic Chronicle* 9: 145–61.

———(1972) 'The metallurgical analysis of Roman Imperial silver and aes coinage'. in *Methods of Chemical and Metallurgical Investigation of Ancient Coinage*. (London: Royal Numismatic Society), pp. 3–47.

Corbier, M.(2015) 'Coinage and Taxation: The State's Point of View, AD 193-337'. in *The Cambridge Ancient History. Vol XII: the Crisis of Empire, A.D. 193-337*. (Cambridge: Cambridge University Press), pp. 327–92.

Crawford, M. H.(1969) 'Coin hoards and the pattern of violence in the late Republic'. *Papers of the British School at Rome* (37): 76–81.

———(1970) 'Money and exchange in the Roman world'. *The Journal of Roman Studies* 60 (1970): 40–8.

———(1975) 'Finance, coinage and money from the Severans to Constantine'. in H. Temporini (ed.). *Aufstieg und Niedergang der römischen Welt II*. (Berlin: De Gruyter), pp. 560–93.

———(1978) 'Ancient devaluations: a general theory'. in *Les 'dévaluations' à Rome. Epoque républicaine et impériale. Volume 1. Actes du Colloque de Rome (13-15 novembre 1975)*. (Rome: Ecole Francaise de Rome).

———(1983) 'Numismatics'. in M. H. Crawford (ed.). *Sources for ancient history*. (Cambridge: Cambridge University Press), pp. 185–233.

———(1985) *Coinage and money under the Roman Republic: Italy and the Mediterranean economy*. (London: Methuen).

Creighton, J.(2014) 'The supply and movement of denarii in Roman Britain'. *Britannia* 45:

121–63.

Davies, J., Meadows, A. and Williams, J.(1997) 'Needham, Norfolk'. in R. Bland and J. Orna-Ornstein (eds.). *Coin hoards from Roman Britain Vol. X*. (London: British Museum Press), pp. 47–8.

de Callataÿ, F.(1995) 'Calculating ancient coin production : seeking a balance'. *The Numismatic Chronicle* 155: 289–312.

———(2005) 'La frappe libre a-t-elle existé dans l'Antiquité gréco-romaine?' in C. Alfaro Asins, C. Marcos, and P. Otero (eds.). *Actas del XIII Congreso Internacional de Numismática*. (Madrid: Ministerio de Cultura, Secretaría General Técnica), pp. 211–8.

de Romanis, F.(2012) 'Julio-Claudian denarii and aurei in Campania and India'. *Annali del istituto Italiano di numismatica* 58: 161–92.

Domergue, C.(1990) *Les Mines de la péninsule Ibérique dans l'Antiquité romaine*. (Rome: Ecole Francaise de Rome).

Dore, J. and Wilkes, J.(1999) 'Excavations directed by J. D. Leach and J. J. Wilkes on the site of a Roman fortress at Carpow, Perthshire, 1964-79'. *Proceedings of the Society of Antiquaries of Scotland* 129: 481–575.

Duncan, G. L.(1999) 'Review of: Later Roman-Barbarian contacts in central Europe. Numismatic Evidence. Studien zu Fundmunzen der Antike (SFMA) Band 11 by Aleksander Bursche'. *The Numismatic Chronicle* 159: 377–9.

Duncan-Jones, R. P.(1994) *Money and Government in the Roman Empire*. (Cambridge: Cambridge University Press).

———(2001) 'The denarii of Septimius Severus and the mobility of Roman coin'. *The Numismatic Chronicle* 161: 75–89.

———(2002) 'The denarii of Septimius Severus and the mobility of Roman coin: further comment'. *The Numismatic Chronicle* 162: 342–5.

Eckhel, J.(1792) *Doctrina numorum veterum, conscripta a Iosepho Eckhel. Pars I, de numis urbium, populorum, regum. Volumen I, continens prolegomena generalia, tum numos Hispaniae, Galliae, Britanniae, Germaniae, Italiae cum insulis*. (Vienna: J.V. Degen).

Elliott, C. P.(2014) 'The Acceptance and Value of Roman Silver Coinage in the Second and Third Centuries AD'. *The Numismatic Chronicle* 129–52.

———(2020) *Economic theory and the Roman monetary economy*. (Cambridge: Cambridge University Press).

Erim, K. T., Reynolds, J. and Crawford, M. H.(1971) 'Diocletian's currency reform: A new inscription'. *Journal of Roman Studies* 61: 171–7.

Esty, W. W.(1984) 'Estimating the size of a coinage'. *The Numismatic Chronicle* 144: 180–3.

———(1986) 'Estimation of the size of a coinage: a survey and comparison of methods'. *The Numismatic Chronicle* 146: 185–215.

Fischer-Bossert, W.(2012) 'The coinage of Sicily'. in W. Metcalf (ed.). *The Oxford Handbook of Greek and Roman Coinage*. (Oxford: Oxford University Press), pp. 142–56.

Frank, T.(1927) *An economic history of Rome*. 2nd Ed. (Baltimore: John Hopkins Press).

Gawlikowski, M.(1994) 'Palmyra as a trading centre'. *Iraq* 56: 27–33.

Gazdac, C.(2012) '"War and Peace"! Patterns of violence through coin hoards distribution-the Middle and Lower Danube from Trajan to Aurelianus'. *Istros* (18): 165–98.

George, N.(2020) 'Experiments reproducing Roman debased alloys'. in K. Butcher (ed.). *Debasement: manipulation of coin standards in pre-modern monetary systems*. (Oxford: Oxbow Books), pp. 75–96.

Gerov, B.(1977) 'Die Einfälle der Nordvölker in den Ostbalkanraum im Lichte der Münzschatzfunde I: Das II. u. III. Jahrhundert (101-284)'. in H. Temporini (ed.). *Aufstieg und Niedergang der römischen Welt II.6*. (Berlin: Walter de Gruyter), pp. 110–81.

Gibbon, E.(1776) *The History of the Decline and Fall of the Roman Empire*. (London: Strahan & Cadell).

Gitler, H. and Ponting, M.(2003) *The silver coinage of Septimius Severus and his family (193-211 AD): a study of the chemical composition of the Roman and Eastern issues*. (Milan: Edizioni Ennerre).

——— and ———(2007) 'Rome and the east: a study of the chemical composition of roman silver coinage during the reign of Septimius Severus AD 193-211'. in M. Sartre (ed.). *Productions et échanges dans la Syrie grecque et romaine (Actes du colloque de Tours, juin 2003)*. (Lyons: Société des Amis de la Bibliothèque Salomon-Reinach), pp. 375–97.

Greaves, J.(1647) *A discourse on the Roman foot and denarius*.

Grierson, P.(1966) 'The President's Address, session 1965-1966: The interpretation of coin finds (2)'. *The Numismatic Chronicle* (6): i – xxi.

———(1975) *Numismatics*. (Oxford: Oxford University Press).

Griffin, M. T.(1984) *Nero: the end of a dynasty*. (London: B.T. Batsford Ltd).

Guest, P. S. W.(1994) *A comparative study of coin hoards from the western Roman empire*. (University College London).

———(2015) 'The burial, loss and recovery of Roman hoards in Britain and beyond: past, present and future'. in J. Naylor and R. Bland (eds.). *Hoarding and the deposition of metalwork from the Bronze Age to the 20th century: a British perspective*. (Oxford: Archaeopress), pp. 101–16.

Guey, J.(1962) 'L'aloi du denier romain de 177 à 211 après J.-C. étude descriptive'. *Revue numismatique* 4: 73–140.

———(1965) 'Peut-on se fier aux essais chimiques ? [Encore l ' Aloi du denier romain de 177 à 211 après J .-C .]'. *Revue numismatique* 7: 110–22.

Haines, G. C.(1941) 'The decline and fall of the monetary system of Augustus'. *The Numismatic Chronicle* 17–47.

Haklai-Rotenberg, M.(2011) 'Aurelian's monetary reform: between debasement and public trust'. *Chiron* 41: 1–39.

Hall, J.(1986) 'A hoard from Billingsgate, London'. in A. Burnett and R. Bland (eds.). *Coin hoards from Roman Britain Vol. VI*. (London: British Museum Press), pp. 57–8.

———(2014) ‘With criminal intent? Forgers at work in Roman London’. *Britannia* 45: 165–94.

Hammer, J.(1908) ‘Der Feingehalt der griechischen und römischen Münzen : ein Beitrag zur antiken Münzgeschichte’. *Zeitschrift für Numismatik* 26: 1–144.

Hammond, M.(1946) ‘Economic stagnation in the early Roman Empire’. *The Journal of Economic History* 6 (Supplement): 63–90.

Hanson, W. S.(1978) ‘Roman campaigns north of the Forth-Clyde isthmus: the evidence of the temporary camps’. *Proceedings of the Society of Antiquaries of Scotland* 109: 140–50.

Harl, K.(1996) *Coinage in the Roman economy, 300 BC to AD 700*. (Baltimore: The John Hopkins University Press).

Haselgrove, C. and Wigg-Wolf, D. (eds.)(2005) *Iron Age coinage and ritual practices*. (Mainz am Rhein: Von Zabern).

Hellings, B.(2016) ‘The denarii of Septimius Severus and the mobility of Roman coin: the case of Roman Germany’. *The Numismatic Chronicle* 176: 171–82.

Hirt, A.(2010) *Imperial mines and quarries in the Roman world: organizational aspects 27 BC-AD 235*. (Oxford: Oxford University Press).

Hobbs, R.(1992) ‘Woodham Mortimer, Essex’. in R. Bland (ed.). *Coin hoards from Roman Britain Vol. IX*. (London: British Museum Press), pp. 20–3.

———(1997) *Late Roman precious metal deposits, c.AD 200-700: changes over time and space*. (University College London).

———(2006) *Late Roman precious metal deposits, c. AD 200-700: changes over time and space*. (Oxford: Archaeopress).

Hodgson, N.(2014) ‘The British Expedition of Septimius Severus’. *Britannia* 45 (2014): 31–51. http://dx.doi.org/10.1017/S0068113X1300055X

Holmes, N. M. M.(2003) ‘Roman coins’. in N. M. M. Holmes (ed.). *Excavation at Roman sites at Cramond, Edinburgh*. (Edinburgh: Society of Antiquaries of Scotland), pp. 94–102.

———(2006) ‘Two denarius hoards from Birnie, Moray’. *British Numismatic Journal* 76: 1–44. http://repository.nms.ac.uk/884/

———(2014) ‘The Synton and Kippilaw denarius hoards : further numismatic evidence for late Antonine and Severan Scotland’. *Proceedings of the Society of Antiquaries of Scotland* 144: 133–67.

———(2017) ‘The Roman coins’. in M. Cook, J. A. Lawson, and D. McLaren (eds.). *Excavations and interventions in and around Cramond Roman fort and annexe, 1976 to 1990*. (Edinburgh: The Society of Antiquaries of Scotland), pp. 53–5.

Howgego, C.(1990) ‘Why did ancient states strike coins?’ *The Numismatic Chronicle* (150): 1–25.

———(1994) ‘Coin circulation and the integration of the Roman economy’. *Journal of Roman Archaeology* 7: 5–21.

———(1995) *Ancient History from Coins*. (London: Routledge).

———(2002) ‘The denarii of Septimius Severus and the mobility of Roman coin: a reply’. *The Numismatic Chronicle* 162: 339–42.

———(2009) ‘Some numismatic approaches to quantifying the Roman economy’. in A. Bowman and A. Wilson (eds.). *Quantifying the Roman economy: methods and problems*. (Oxford: Oxford University Press), pp. 287–95.

Hultsch, F.(1862) *Griechische und römische Metrologie*. (Berlin: Weidemann).

Hunter, F.(2007) ‘Silver for the barbarians: interpreting denarii hoards in northern Britain and beyond’. in R. Hingley and S. Willis (eds.). *Roman Finds: Context and Theory*. (Oxford: Oxbow Books), pp. 214–24. http://kar.kent.ac.uk/10433/

Ireland, S.(2013) *The South Warwickshire hoard of Roman denarii: a catalogue*. (Oxford: Archaeopress).

Johns, C.(1997) *The Snettisham Roman jewellers hoard*. (London: British Museum).

Jones, A. H. M.(1959) ‘Review of: State and Currency in The Roman Empire to 300 A . D by Sture Bolin’. *The Economic History Review, New Series* 12 (1): 160–3.

———(1974) *The Roman Economy: studies in ancient economic and administrative history*. P. A. Brunt (ed.). (Oxford: Blackwell).

Jones, G. D. B.(1980) ‘The Roman Mines at Riotinto’. *The Journal of Roman Studies* 70: 146–65.

Katsari, C.(2011) *The Roman monetary system: the eastern provinces from the first to the third centuries AD*. (Cambridge: Cambridge University Press).

Kemmers, F.(2006) *Coins for a legion : an analysis of the coin finds from Augustan legionary fortress and Flavian canabae legionis at Nijmegen*. (Mainz am Rhein: Von Zabern).

Knapp, G. F.(1924) *The state theory of money*. 4th Ed. (London: Macmillan and Company Limited).

Kolendo, J.(1978) ‘L’arrêt de l'afflux des monnaies romaines dans le “Barbaricum” sous Septime-Sévère’. in *Les ‘dévaluations’ à Rome. Epoque républicaine et impériale. Volume 2. Actes du Colloque de Rome (13-15 novembre 1975)*. (Rome: Ecole Francaise de Rome), pp. 169–72.

———(1980) ‘L’arrêt de l'afflux des monnaies romaines dans le “Barbaricum” sous Septime-Sévère’. *Les ‘dévaluations’ à Rome. Epoque républicaine et impériale. Volume 2. Actes du Colloque de Gdansk (19-21 octobre 1978)* 2: 169–72.

Kroll, J. H.(2012) ‘The monetary background of early coinage’. in W. Metcalf (ed.). *The Oxford Handbook of Greek and Roman Coinage*. (Oxford: Oxford University Press), pp. 33–42.

Kropff, A.(2016) *New English translation of the Price Edict of Diocletianus*.

Kubitscheck, W.(1896) *Rundschau über ein Quinquennium der Antiken Numismatik, 1890-1894*. (Vienna: A Holder).

La Gentilhomme, P.(1946) ‘Le trouvaille de Nanterre’. *Revue numismatique* 9: 15–114.

La Niece, S.(1995) ‘Depletion Gilding from Third Millennium BC Ur’. *Iraq* (January): 41–7.

Lewis, N.(1983) *Life in Egypt under Roman rule*. (Oxford: Clarendon).

Lind, L.(1981) *Roman denarii found in Sweden*. (Stockholm: Almqvist & Wiksell).

Lo Cascio, E.(1980) 'La riforma monetaria di Nerone: l'evidenza dei ripostigli'. *Mélanges de l'Ecole française de Rome. Antiquité* 92 (1): 445–70.

———(1981) 'State and coinage in the late Republic and early Empire'. *The Journal of Roman Studies* 71: 76–86.

———(1984) 'Dall'antoninianus al "laureato grande": l'evoluzione monetaria del III secolo alla luce della nuova documentazione dietà Dioclezianea'. *Opus* 3: 133–201.

———(1996) 'How did the Romans view their coinage and its function?' in *Coin finds and coin use in the Roman world. The thirteenth Oxford symposium on coinage and monetary history, 25-27.03.1993*. (Berlin: Gebr. Mann).

———(2005) 'The emperor and his administration'. in A. Bowman, P. Garnsey, and A. Cameron (eds.). *The Cambridge Ancient History. Vol XII: the Crisis of Empire, A.D. 193-337*. (Cambridge: Cambridge University Press).

Lockyear, K.(1996) *Multivariate money: a statistical analysis of Roman Republican coin hoards with special reference to material from Romania*. (University College London).

———(1999) 'Hoard structure and coin production in antiquity - an empirical investigation'. *The Numismatic Chronicle* 159 (159): 215–43.

———(2012) 'Dating coins, dating with coins'. *Oxford Journal of Archaeology* 31 (2): 191–211.

Mac Dowall, D.(1979) *The western coinages of Nero*. (New York: American Numismatic Society).

———(1991) 'Indian imports of Roman silver coins'. in A. K. Jha (ed.). *Coinage, trade and economy. January 8th-11th 1991, 3rd international colloquium*. (Anjaneri: Indian Institute of Research in Numismatic Studies), pp. 145–63.

Macleod, H. D.(1858) *The elements of political economy*. (London: Longman, Brown, Green, Longman and Roberts).

Macro, A. N.(1976) 'Imperial Provisions for Pergamum: OGIS 484'. *Greek, Roman and Byzantine Studies* (17): 169–79.

Mattingly, H.(1928) *Roman coins from the earliest times to the fall of the Western Empire*. (London: Methuen).

———(1930) *Coins of the Roman empire in the British Museum. Vol. 2: Vespasian to Domitian*. (London: British Museum).

———(1951) 'The clash of coinages circa 270-296'. in P. R. Coleman-Norton (ed.). *Studies in Roman and economic history in honour of Allan Chester Johnson*. (Princeton: Princeton University Press), pp. 275–89.

Meeks, N., Mongiatti, A. and Joy, J.(2010) 'Precious metal torcs from the Iron Age Snettisham treasure: metallurgy and analysis'. in E. Pernicka and R. Schwab (eds.). *Under the Volcano: Proceedings of the International Symposium on the Metallurgy of the European Iron Age (SMEIA) held in Mannheim, Germany, 20–22 April 2010*. (Rahden: Verlag Marie Leidorf), pp. 135–56.

Metcalf, W.(1995) 'Review of: Money and Government in the Roman Empire by Richard

Duncan-Jones'. *Revue suisse de numismatique* 74: 145–59.

Mickwitz, G.(1932) *Geld und Wirtschaft im römischen Reich des vierten Jahrhunderls n. Chr*. (Helsingfors: Akademische Buchhandlung).

Mirnik, I.(1981) *Coin hoards in Yugoslavia*. (Oxford: British Archaeological Reports).

Mommsen, T.(1860) *Geschichte der römischen Münzwesens*. (Berlin: Weidemann).

———(1873) *Histoire de la monnaie romaine. Volume 3*. J. de Witte and L.-C.-P.-C. de B. de Blacas D'Aulps (eds.). (Paris: Rollin et Feuardent).

Murphy, N. P.(2015) *A denarius perpetuus? The circulation of the 'legionary denarii' of Mark Antony in Roman Italy and Britain 32 BC-AD 294*. (The University of Warwick).

Orna-Ornstein, J.(1997) 'Early hoards of denarii from Britain'. in R. Bland and J. Orna-Ornstein (eds.). *Coin hoards from Roman Britain Vol. X*. (London: British Museum Press), pp. 23–9.

Patin, C.(1667) *Introduction à la Connaissance des Medailles*. (Paris: Jean Du Bray).

Pfuntner, L.(2016) 'Celebrating the Severans : Commemorative Politics and the Urban Landscape in High Imperial Sicily'. *Latomus* 75 (2): 434–56.

Pinkerton, J.(1808) *An Essay on Medals: Or, An Introduction to the Knowledge of Ancient and Modern Coins and Medals; Especially Those of Greece, Rome, and Britain. Third Edition, Volume 1*. (London: T. Cadell and W. Davies).

Ponting, M.(2009) *Roman silver coinage: mints, metallurgy and production*. A. Bowman and A. Wilson (eds.). (Oxford: Oxford University Press). http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199562596.001.0001/acprof-9780199562596

———(2012) 'The Substance of Coinage: The Role of Scientific Analysis in Ancient Numismatics'. in W. Metcalf (ed.). *The Oxford Handbook of Greek and Roman Coinage2*. (Oxford: Oxford University Press), pp. 12–30.

Potter, D. S.(2004) *The Roman empire at bay: AD 180-395*. (London: Routledge).

Potter, T.(1986) 'A Roman jeweller's hoard from Snettisham, Norfolk'. *Antiquity* 60 (229): 137–9.

Prosdocimi, A.(1891) 'Di un ripostiglio di monete romane, scoperto nella "Villa Boiani"'. *Notizie degli scavi di antichità* 279–81.

Rathbone, D.(1996) 'Monetisation, not price-inflation, in third-century A.D. Egypt?' in C. E. King and D. Wigg-Wolf (eds.). *Coin finds and coin use in the Roman world. The thirteenth Oxford symposium on coinage and monetary history, 25-27.03.1993*. (Berlin: Gebr. Mann), pp. 321–39.

Reece, R.(1968) 'Analyses of some early third century Roman silver coins'. *The Numismatic Chronicle* 8: 111–3.

———(1972) 'A Short Survey of the Roman Coins Found on Fourteen Sites in Britain'. *Britannia* 3: 269–76.

———(1974) 'Numerical aspects of Roman coin hoards in Britain'. in P. J. Casey and R. Reece (eds.). *Coins and the archaeologist*. (London: Seaby), pp. 78–94.

———(1981a) ‘Coinage and currency in the third century’. in A. King and M. Henig (eds.). *The Roman West in the third century: contributions from archaeology and history*. (Oxford: British Archaeological Reports), pp. 79–88.

———(1981b) ‘The “normal” hoard’. in C. Carcassonne and T. Hackens (eds.). *Statistique et numismatique*. (Strasbourg: Conseil de l’Europe, Assemblée parlementaire), pp. 299–308.

———(1987) *Coinage in Roman Britain*. (London: Seaby).

———(1996) ‘The interpretation of site finds- a review’. in C. E. King and D. Wigg-Wolf (eds.). *Coin finds and coin use in the Roman world. The thirteenth Oxford symposium on coinage and monetary history, 25-27.03.1993*. (Berlin: Gebr. Mann), pp. 341–55.

———(2003a) ‘Coinage and currency in the third century’. in A. King and M. Henig (eds.). *Roman coins and archaeology: collected papers*. (Oxford: British Archaeological Reports), pp. 335–41.

———(2003b) ‘Coins and frontiers: the Falkirk hoard reconsidered’. in *Roman coins and archaeology: collected papers*. (Wetteren: Moneta), pp. 277–82.

———(2003c) ‘Numerical aspects of Roman coin hoards in Britain’. in R. Reece (ed.). *Roman coins and archaeology: collected papers*. (Wetteren: Moneta), pp. 268–76.

———(2003d) ‘The “normal” hoard’. in R. Reece (ed.). *Roman coins and archaeology: collected papers*. (Wetteren: Moneta), pp. 283–8.

Reed, N.(1975) ‘The Scottish campaigns of Septimius Severus’. *Proceedings of the Society of Antiquaries of Scotland* 92–102.

Regling, K.(1912) ‘Römischer Denarfund von Fröndberg’. *Zeitschrift für Numismatik* 29: 189–253.

———(1931) ‘Der Schatz römischer Goldmünzen von Diarbekir (Mardin)’. *Blätter für Münzfreunde* 66: 353–65, 369–81.

Robertson, A. S.(2000) *An inventory of Romano-British coin hoards*. (London: The Royal Numismatic Society).

Romé de l’Isle, J. B. L.(1789) *Metrologie; ou tables pour servir a l’intelligence des poids et mesures des anciens, et principalement a determiner la valeur des monnoies Grecques et Romaines*. (Paris: Impr. de Monsieur).

Rostovtzeff, M.(1926) *The Social and Economic History of the Roman Empire*. (Oxford: Clarendon).

Rostovtzeff, M.(1957) *The Social and Economic History of the Roman Empire, vol. 1*. 2nd Ed. (Oxford: Oxford University Press).

Sargent, T. J. and Velde, F. R.(2001) *The big problem of small change*. (Princeton: Princeton University Press).

Savot, L.(1627) *Discours sur les médailles antiques, divisé en quatre parties, esquelles il est tracté si les médailles antiques estoient monnayes*. (Paris: Sebastien Cramoisy).

Scheidel, W.(2008) ‘The divergent evolution of coinage in Eastern and Western Eurasia’. in W. V. Harris (ed.). *The monetary systems of the Greeks and Romans*. (Oxford: Oxford University Press), pp. 267–86.

———(2010) ‘Coin quality, coin quantity, and coin value in early China and the Roman world’. *American Journal of Numismatics* 22 (22): 93–118.

Schmitt-Korte, K. and Cowell, M.(1989) ‘Nabataean Coinage — Part I . The Silver Content Measured by X-Ray Fluorescence Analysis’. *The Numismatic Chronicle* 149: 33–58.

Semenova, A.(2011) *The origins of money: evaluating chartalist and metallist theories in the context of ancient Greece and Mesopotamia*. (University of Missouri-Kansas City).

Southern, P.(1997) *Domitian. Tragic tyrant*. (London: Routledge).

Soutzo, M.(1898) ‘Etude sur les monnaies imperiales romaines II. Le systeme monetaire de Neron’. *Revue numismatique* 659–66.

Strobel, K.(1993) *Das Imperium Romanum im ‘3. Jahrhundert’: Modell einer historischen Krise? Zur Frage mentaler Strukturen breiterer Bevölkerungsschichten in der Zeit von Marc Aurel bis zum Ausgang des 3. Jh.n.Chr*. (Stuttgart: Franz Steiner).

Thornton, M. E. K.(1971) ‘Nero’s New Deal’. *Transactions and Proceedings of the American Philological Association* 102: 621–9.

Todd, M.(1985) ‘The Falkirk hoard of denarii: trade or subsidy?’ *Proceedings of the Society of Antiquaries of Scotland* 115: 229–32.

Turner, P. J.(1989) *Roman coins from India*. (London: Royal Numismatic Society).

Verboven, K.(2007) ‘Demise and Fall of the Augustan Monetary System’. in O. Hekster, G. de Kleijn, and D. Slootjes (eds.). *Crises and the Roman Empire: Proceedings of the 7th Workshop of the International Network Impact of Empire, Nijmegen, 2006*. (Leiden: Brill), pp. 245–57.

———(2009) ‘Money, currency and accounts: monetary modes in the Roman world’. *Revue belge de numismatique et de sigillographie* (155): 91–121.

von Rauch, A.(1857) ‘Über die römischen Silbermünzen und den inneren Werth derselben’. *Mittheilungen der numismatischen Gesellschaft in Berlin* 3: 282–308.

Walker, D. R.(1976) *The metrology of the Roman silver coinage. Part 1: from Augustus to Domitian*. (Oxford: British Archaeological Reports).

———(1978) *The metrology of the Roman silver coinage. Part 3: from Pertinax to Uranius Antoninus*. (Oxford: British Archaeological Reports).

———(1988) ‘Roman coins from the Sacred Spring at Bath’. in B. W. Cunliffe (ed.). *The temple of Sulis Minerva at Bath II: Finds from the Sacred Spring*. (Oxford: Oxford University Committee for Archaeology), pp. 281–358.

Walton, P. J.(2008) ‘Finds from the River Tees at Piercebridge, County Durham’. in H. Cool and D. Mason (eds.). *Roman Piercebridge: excavations by D.W. Harding and Peter Scott 1969-1981*. (Newcastle: Newcastle: Architectural and Archaeological Society of Durham and Northumberland), pp. 286–93.

———(2011) *Rethinking Roman Britain : An Applied Numismatic Analysis of the Roman Coin Data Recorded by the Portable Antiquities Scheme*. (University College London). http://discovery.ucl.ac.uk/1318144/1/1318144.pdf

Wassink, A.(1991) ‘Inflation and Financial Policy under the Roman Empire to the Price Edict of 301 AD’. *Historia: Zeitschrift für Alte Geschichte* 40 (4): 465–93.

Weerakkody, D. P. .(1995) ‘Roman coins of Sri Lanka: some observations’. *The Sri Lanka Journal of the Humanities* 21: 1–30.

West, L. C.(1941) *Gold and silver coin standards in the Roman empire*. (New York: The American Numismatic Society).

Williams, J.(1997) ‘Morton Lodge (addenda)’. in R. Bland and J. Orna-Ornstein (eds.). *Coin hoards from Roman Britain Vol. X Roman Britain X*. (London: British Museum).

Witschel, C.(1999) *Krise - Rezession - Stagnation?: Der Westen des römischen Reiches im 3. Jahrhundert n. Chr.* (Frankfurt: Marthe Clauss).

———(2004) ‘Re-evaluating the Roman west in the 3rd c. AD’. *Journal of Roman Archaeology* 17: 251–81.