6 The Strangeness of Rome's Early Heavy Bronze Coinage

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6.1 The Money Problem

Roman coinage is one of the most important and certainly most tangible 'firsts' of the Middle Republican period. This chapter suggests we have not yet looked as hard as we should at the historical implications of cast coinage, as opposed to the relatively well studied (if controversial) early struck coinages.[1] Yet even as these early cast bronzes are some of Rome's earliest 'coins' in a formal sense, in many ways they are quite alien in both form and function to any modern sense of that word.

Typically, we tend to think about money as either having intrinsic value or operating by fiat. For instance, your average person might assume that a gold or silver coin should have the same value as its metal content, and yet that same person is likely equally comfortable with a piece of paper that says it is legal tender because we use it in all the same ways we use a precious metal coin with an assumed intrinsic value. The vast majority of our economic transactions are simply bookkeeping tallies of credits and debits facilitated by various financial institutions authorized by and to varying degrees overseen by our governments. There is no big vault with all the physical money in it that is represented by what we spend or save via coded electronic messages. Understanding fiat money isn't hard – we use it all the time. The intellectual challenge is understanding how far back in history one can observe similar monetary practices. We tend to assume that without tangible money ancient people were reduced to barter, and that even with money ancient peoples expected physical objects to have intrinsic value. One purpose of this chapter is to help further dispel these ideas.

We are relatively confident that Rome partook in the wider northern and central Italic tradition of using bronze as money, at least in the sense of a unit of account and measure of value, long before it ever issued coinage. The usual evidence cited for this is the list of fines in the Twelve Tables.

[1] Coarelli 2013 with Burnett and Crawford 2014 and Bernard 2017. Generally, specific issues are referred to following convention by their *RRC* classification number in Crawford 1974.

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However, the tables do not explicitly mention the unit or material to which the number corresponds.[2] Support for this hypothesis has been seen in Latin vocabulary, including such phrases as *pendere poenas* ('to weigh fines') or the word *stipendium* (a 'weighed heap').[3]

James Tan's chapter in this volume (Chapter 3) demonstrates the degree to which the Romans were capable of using complicated systems of account to track credits and debits for the *tributum-stipendium* system long before they issued coinage. A monetized economy requires a means by which accounts may be kept, value stored, and payments made; coinage itself is not required. Multiple things can function as money – grain, metal, cattle, but also just the credit and debts themselves. The unit of account was primarily bronze, and bronze could be used to store value and also to make payments, but in most instances credits and debits reckoned in bronze units are likely to have been the most common means of transaction.

Imagine this scenario: you bring me three sacks of wheat worth three *asses*, and I credit two *asses* towards your next *tributum* payment and then give you one *as* worth of wine, and now we're even. No physical money changes hands, but the transaction still presumes a common monetary system. Or perhaps you take your remaining wheat home and save it or even eat it, or you ask if I'd buy it, and you get a hunk of bronze.

The next problem is the nature of that piece of bronze. What makes it valuable? Is it fungible? To be fungible it must be possible to swap it with any other similar piece of bronze of the same value. Bullion is by nature fungible. It doesn't matter what shape your gold is in, bars, ingots, torques, coins, it is all fungible (assuming similar levels of purity, of course).

Is that piece of bronze bullion? Does it have intrinsic value as raw material? Historians have long assumed the answer to that question is yes, but the more we know about the evidence the less that seems to be the case, and the more complex it makes our understanding about the moment Rome began making coins.

Early Roman cast bronze monetary instruments are today called *aes rude* and *aes formatum*. *Aes rude* is the term used for bronze pieces of just about any metallurgical formula, which we presume to have been used as money and which appear shapeless to modern eyes. *Aes formatum* is much the same but the shape of the pieces seems more deliberate, usually taking the form of ingots or discs, often referred to as 'loaves' or 'buns', perhaps even

[2] See Crawford 1996: 2.606 discussing reconstruction and emphasizing significance of Festus 508L.

[3] Kroll 2008; Varro, *LL* 5.169–83.

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with some minimal design element but not apparently conforming to any weight standard.[4]

Metallurgical testing has revealed considerable variety to the composition of *aes rude*, and this makes it harder to believe that *aes rude* functioned as bullion. Some of the best-studied material is that retrieved in controlled excavations from Ghiaccioforte, the site of a small oppidum in Etruria (near modern Scansano) occupied in the late fourth century BCE but destroyed circa 280 BCE, in the period shortly before the introduction of Roman *aes grave*. Analysis of twenty specimens from Ghiaccioforte showed at least five different metallurgical groupings, while the characteristic that most stands out is the number of pieces with high iron content where iron has been dissolved into the bronze.[5] The alloying of iron and copper is not naturally occurring and requires significantly high temperatures of circa 1536°C (2696.8°F). Furthermore, for practical purposes such ferruginous alloys are useless for producing other metal objects by means of casting or hot and cold working, meaning pieces with this profile had little intrinsic value as raw material.[6] The Ghiaccioforte finds do not appear to be anomalous, as scientific analyses of a Sardinian hoard of *aes rude* and of *ramo secco* in the British Museum likewise reveal high iron contents.[7]

The variable and ferruginous metallurgical profiles of *aes rude* and *aes formatum* suggest we need to let go of a bullion or intrinsic-value model in which these objects functioned as stocks of raw materials and begin to think about how this material might have functioned as a type of fiat money. However, the bullion and intrinsic-value model for *aes rude* and *aes formatum* underpins most of our thinking about Rome's earliest bronze coinage, the heavy cast coins we call *aes grave*, meaning heavy bronze.[8] This link not only derives from the metal and weight of this earliest bronze coinage, but also from the fact that *aes rude*, *aes formatum*, and early *aes grave* all appear in the same find contexts and seem to function in very similar ways. At Praeneste, a single piece of *aes rude* was commonly deposited alongside other grave goods; in the 2004–7 excavations at the Colombella necropolis *aes grave* pieces (presumably of local manufacture)

[4] A new typology of this class of object based on a re-evaluation of the Mazin hoard (Croatia) has been recently proposed, Bertol and Farac 2012, but one focused on Italian finds is still needed; cf. Thurlow and Vecchi 1979: plates 2–9, Vecchi 2014: 76 with plates 83–90 and Haeberlin 1910: plates 1–9.

[5] Baldassarri et al. 2007. [6] Ingo et al. 2006: 217.

[7] De Caro, Ingo, and Salvi 2005; Burnett, Craddock, and Meeks 1986.

[8] We do not (yet) have published scientific results of the metallurgical composition of Roman *aes grave*, although hopefully testing will be forthcoming which could help determine its typical profile and possible iron content.

were found in a rich layer of ancient deposition separate from the tombs themselves.[9] At the sanctuary at Pyrgi, ritual deposits have been found containing *aes formatum* buried in an *olla*, and also quadrans from an early series of Roman *aes grave* (*RRC* 14) was similarly buried in an *olla*.[10] Votive offerings found at Nemi or Vicarello contained both *aes rude* and *aes grave* as well as later struck coinage.[11] Notably, *aes rude*, *aes formatum*, and early *aes grave* are commonly found in association with sacred or ritual spaces.[12] If we think that *aes grave* connects functionally in some way to the earlier bronze classes of *aes rude* or *aes formatum*, then the apparent lack of a bullion function to the earlier material makes it harder to assume that the heaviness of *aes grave* relates in turn to its intrinsic value.

This paper analyses available metrological data for the three earliest issues of *aes grave* to further demonstrate the limited value of a bullion or intrinsic-value model for early Roman bronze cast coinage. Once these limitations are fully realized, we are left to confront the 'strangeness' of the phenomenon of creating such a heavy coinage as a type of fiat money. As coins, these *aes grave* were, after all, serially made objects, and their reproduction on supposed standard weight units has been seen to differentiate them from the *aes rude* and *aes formatum*, which preceded them. The following shows that this idea of uniform or standardized weights is less sound than is often thought. This perhaps strengthens the relationship of early *aes grave* with those bronze objects, which preceded it, but it continues to pose interesting historical questions. What made it desirable to

[9] These *aes grave* finds are not yet published but are already on public display at the local museum because of their historical importance; photographs are available on the author's personal website: Liv Mariah Yarrow, 'Aes Rude and Aes Grave, Praeneste Finds', *Adventures in My Head* [blog], 26 October 2019, https://livyarrow.org/2019/10/26/aes-rude-and-aes-grave-praeneste-finds/. The two specimens on display are both of the bull-head/prow type (HN Italy 359 = Vecchi 276 = Haeberlin 157–8). One of the pieces has been pierced so as to allow it to be hung on a string and perhaps worn. The excavator, Prof. Gatti, kindly discussed the context finds with the author in private correspondence and shared further images of the finds; this deposition layer also contained a Roman *as* with minimal wear of the McCabe's Group E type which is related to *RRC* 106 and likely made in Etruria (McCabe 2013: 145–8), thus suggesting the deposition layer closed during or after the Second Punic War. Haeberlin no. 9 was also found at Praeneste and another specimen was part of the Ariccia 1848 hoard (*RRC*H 13; c. 28 km SW of Praeneste). The museum also displays many complete grave goods assemblages from recent excavations (cf. Gatti 2009), but the common appearance of a single piece of *aes rude* in these burials was already well documented by Fernique 1878 and Vaglieri 1907. Fernique 1878 descriptions are particularly interesting because they record the finding in a level below the *aes rude* of a coin likely to be of the HN Italy 644 type (c. 325–275 BCE), thus strongly supporting the use of *aes rude* well into the third century.

[10] Baglione et al. 2015: 225; Drago Troccoli 2013; and Ambrosini and Michetti 2013.

[11] Crawford 1983; Tocci 1967–8.

[12] Cf. Jaia and Molinari 2011 for discussion.

have such a physically large monetary object when other types of small struck coinage were well known from neighbouring culture groups?

6.2 Rome's Earliest Bronze and Its Denomination Structure

Rome's very earliest bronze coinage is all cast and consists of three issues (Table 6.1). Casting is a slower manufacturing technique than striking but allows for larger coins to be produced. The hoard evidence makes clear that all three issues were produced well before other cast bronzes. Far fewer specimens of *RRC* 19 survive, but two hoards help us securely group it with the other two issues. Neither the exact nor relative chronology of these three issues has been firmly established. Modern scholarly treatments of the evidence begin from the work of Haeberlin's *Aes Grave: das Schwergeld Roms und Mittelitaliens einschliesslich der ihm vorausgehenden Rohbronzewährung* (1910), which documented the location and weight of every specimen then known, reviewed all previous publications, and published multiple illustrations of each type. Haeberlin was an avid collector and many of the specimens he documents were from his own collection. The material was treated holistically alongside the other coinage with a primarily chronological interest by Thomsen in *Early Roman Coinage: A Study of the Chronology* (1957–1961). Crawford's landmark study of the whole of *Roman Republican Coinage* (1974) remains the most consulted reference work, and for the *aes grave* he was much influenced by both Haeberlin and Thomsen. In particular, Crawford followed Thomsen in placing the Dioscuri/Mercury series (*RRC* 14) some five to ten years earlier than the Apollo/Apollo series (*RRC* 19), but, as we shall see, this ordering is based on assumptions about the development of the weight standards for this early coinage.

There is some shared iconography between these issues and black glaze ware (*vernice nera*) of the third-century *atelier des petites estampilles* produced around 280–260 BCE.[13] A temporal connection between this pottery class and early *aes grave* is strengthened by the discovery of a ritual deposit of both examples together both at the Sanctuary of Sol Indiges (Torvaianica) and at the Sanctuary at Pyrgi.[14] The iconographic parallels, however, are not a secure means of dating the *aes grave*: these same pottery

13 Cf. Stanco 2009: fig. 5 no. 25, fig. 13 nos. 67–73 and 84–8; Jaia and Molinari 2011: 87 briefly touch on the iconographic parallels.

14 Jaia and Molinari 2011, especially plate 7; Ambrosini and Michetti 2013: 131–3; a temporal connection was posited by Burnett 1989: 64. For discussion of production and association with temple economies, see Di Guiseppe 2012: 62–70, 89–90, and 95.

Table 6.1 *Overview of denominations and types*

Denominations				Types		
Name[*]	Relative value		Symbol	*RRC* 14/1–7	*RRC* 18/1–6 All mirror-image designs	*RRC* 19/1–2
As	1 as	12 *uncia*	|	Beardless Janus[**] and Mercury	Apollo	Dioscurus and Apollo
Semis	1/2-as	6 *uncia*	S	Mars and Venus[†]	Pegasus	Roma and Faunus[‡]
Triens	1/3-as	4 *uncia*	••••	Dolphin and thunderbolt	horse head	n/a
Quadrans	1/4-as	3 *uncia*	•••	Palm of right hand and two kernels of grain	boar	n/a
Sextans	1/6-as	2 *uncia*	••	Scallop shell (outside) and caduceus	Dioscurus	n/a
Uncia	1/12-as	1 *uncia*	•	Knucklebone and only denomination symbol	one kernel of grain	n/a
Semuncia	1/24-as	½ *uncia*	Σ	Acorn and only denomination symbol	n/a	n/a

Prepared by the author.

* The ancient names of coin types are relatively well attested in later sources; the earliest and most complete overview is Varro, *LL* 5.169–73.

** Cf. Molinari 2014 with reference to earlier scholarship.

† For this identification, see Haeberlin 1910: 94; Thomsen 1957–61 (1957): 59; *pace* Crawford 1974: 133. Likewise, other 'Minerva' identifications on the *aes grave* by Crawford must be corrected to Mars: *RRC* 21/2, 25/5, and 27/6.

‡I endorse Massa-Pairault 2011's identification of the reverse as based on the iconography of Lycaean Pan; it may derive from the iconography on the tetradrachms of Antigonos II Gonatas (after 274 BCE). Antigonos' iconography of Pan itself derives from the iconography of the fourth-century obols of the Arcadian league, cf. Warren 1989: 294 no. 54.

impressions also share strong visual parallels with the designs found on non-Roman *aes grave* that are typically dated to the First Punic War and some even down through the Second Punic War.[15] In the opinion of this

[15] Parallels include (an illustrative, not complete, list): five-pointed star: Stanco 2009: fig. 5 no. 21 with Vecchi 2014: nos. 306–7; frog: Stanco 2009: fig. 5 no. 30 and fig. 13 no. 66 with Vecchi 2014:

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author, it is most likely that the shared iconography on both pottery stamps and on *aes grave*, in both Roman and non-Roman contexts, is influenced by the types of symbols found in other cultural contexts, including intaglios used as signet rings, the impressions of which were markers of identity, as well as guarantors of the authenticity of communications, contracts, and more.[16]

Otherwise, our best evidence for dating the early heavy bronze comes from the work of Jaia and Molinari's publication of two foundation deposits containing both *RRC* 14 and 18, but no later issues, at the fortified Sanctuary of Sol Indiges along the coast below Lavinium.[17] They emphasize how other hoards containing *RRC* 14 and 18 cluster around the coastline south of Rome.[18] They suggest that *aes grave* was created in the first instance as part of Roman efforts to improve coastal defences ahead of an anticipated clash with Carthaginian naval power in the Tyrrhenian Sea. As for the function and appearance of the coinage, Jaia and Molinari follow the long-standing and little-questioned hypothesis of Burnett, who suggested that Romans adopted the fixed-weight standard, circular shape, and double-sided design of Greek coinage prevalent in Southern Italy for many centuries, and then adapted it to the Central and North Italian tradition of using cast bronze as a monetary instrument.[19]

The bullion model discussed in the previous section is at the heart of the argument for dating *RRC* 14 earlier than *RRC* 18, despite the implication that the second series was heavier than the first. Based on Haeberlin's observed specimen weights, Thomsen assumed that the Beardless Janus and Mercury *as* (*RRC* 14/1) was intended to weigh 288 Roman scruples, that is precisely one Roman pound, and the Apollo and Apollo *as* (*RRC* 18/1) was intended to weigh 300 scruples. A scruple is the 1/288 part of a whole. Because Thomsen believed *RRC* 14 was closer to the weight of the

nos. 219, 225, 291, and 342; triskeles: Stanco 2009: fig. 5 no. 29 with Vecchi 2014: no. 291; star and crescent: Stanco 2009: fig. 5 no. 22 with Vecchi 2014: nos. 282, 364–7; insect (cicada?): Stanco 2009: fig. 5 no. 35 with Vecchi 2014: nos. 220 and 226.

16 For example frog intaglios: Walters inv. no. 42.1136 (= Marlborough gems no. 449); Thorvaldsen inv. no. I1487; British Museum 1865,0712.114 (an italic scarab); cf. frog stamps and *aes grave* imagery cited in previous note. For intaglios as markers of identity, see Yarrow 2018 with earlier bibliography.

17 Jaia and Molinari 2011; cf. Bernard 2018a: 175–81.

18 See Yarrow 2021: 12–13, especially n. 6 for details of a hoard dispersed in trade in the 1980s and 1990s which likely comes from this same geographical area, but the exact find-spot is now sadly lost. The reported contents of this hoard seem to suggest a similar date between *RRC* 14 and the Roman currency bars (the so-called *aes signatum*). It is surprising that no specimens of the *RRC* 18 type are noted among the hoard contents, but given this report is clearly less concerned with the accurate recording of the *aes grave* and *aes rude* elements than of the currency bars, we might assume they may have gone unreported.

19 Burnett 1989: 55–7.

Roman pound, which he presumed to have been a stable unit, he extrapolated it must then be closer in time to the preceding bullion-based weight system. *RRC* 18 to his mind *must* have been later because it is more than a Roman pound – as he understood it – and thus could not grow out of a monetary system based on weight.[20]

More recent scholarship, however, challenges the assumption that one precise modern weight ought to be assigned to the Roman pound.[21] This would support the general view and approach used by Crawford. He surveyed various estimates for the Roman pound, ranging from 322.56 to 327.45 g, that have been proposed by earlier scholars based on different source materials – coins, stone weights, balances, metal weights. In the end he used circa 324 g, in part because it is easily divisible by 12, with the caveat that it was not reasonable to assume 'that the Romans were able to maintain the weight of their pound absolutely constant, at all times and in all places'.[22]

Any model that emphasizes the intrinsic value of the coin itself seems a poor fit for our physical evidence of the *aes grave*. There are intentionally halved and otherwise intentionally fragmented pieces of non-Roman *aes grave*, but this practice is far from common.[23] I know of only one cut Roman aes grave, a semis found outside peninsular Italy, as well as one additional fragment observed in trade.[24] One of the features that clearly

20 Thomsen 1957–61: (1961), 71.

21 Riggsby 2019: 83–129, esp. 100–7. The Pondera Online Project documents 20,000 weights produced between the mid-sixth century BCE and the mid-fifteenth century CE, many from archaeological contexts and previously unpublished (pondera.uclouvain.be). To this author's knowledge the most complete set of basalt weights found in Latium and with an archeological provenance is the set found in the presumed ancient forum of Praeneste in 1907, now on display in the local museum. All seven weights conform with less than a gram deviation to a Roman pound of 327.4 g, but thus far no precise date for the find is established (Liv Mariah Yarrow, 'A Highly Precise Set of Weights', *Adventures in My Head* [blog], 26 October 2019, https://livyarrow.org/2019/10/26/a-highly-precise-set-of-weights).

22 Crawford 1974: 591.

23 For example Haeberlin 1910: pl. 78.10 of the Iguvium *HN Italy* 26 (Vecchi 2014: 206) type halved; Haeberlin 1910: pl. 79.2 of the Iguvium *HN Italy* 29 (Vecchi 2014: 210) type quartered. 77.6 = Ariminum sword/scabbard type maybe halved. Garrucci 1885: pl. IV.15 may be a quartered cast coin found in the votive deposit at Vicarello, but the drawing leaves the type uncertain.

24 Werz 2015 A fragment is illustrated by Haeberlin 1910: pl. 94.6, but appears broken because the bronze was friable, not as an intentional modification; note also that this is the only known specimen of this specific Crawford subtype 37/1b; cf. Haeberlin 1910: pl. 56.4 a fragment of a specimen of the *RRC* 37/1c. Garrucci 1885: pl. IV.15 may be a quartered cast coin found in the votive deposit at Vicarello, but the drawing leaves type uncertain. By contrast nearly all Roman currency bars (so-called *aes signatum*) to appear in trade today are broken pieces of whole bars, and fragments of Roman currency bars are also very common among our hoards; in the Mazin hoard, we even seem to have two fragments from the same original elephant and pig bar, on which Mirnik 2009: 457. On why the term *aes signatum* is an inappropriate descriptor of the objects, Crawford 2009.

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separates early Roman *aes grave* from other heavy bronze (*aes rude* and *aes formatum*), and also struck bronze and silver in use in central Italy, is its relatively elaborate base-12 denomination system (cf. Table 6.1 above). The inclusion of denomination marks on the coins themselves makes clear the importance of the denomination system to this new form of coinage. A denomination system is in some ways the opposite of a bullion system based on weight. The coin itself proclaims its worth, and the entity issuing the coin expects that the receiver will value the coin as it is marked, that is, without weighing.

The type of bronze denomination system adopted by Rome does have some precedents in Sicily.[25] However, the pellet denomination mark had not been in regular use for more than 100 years when Rome implemented its own similar system on its new heavy bronze. Bronze coins *without* denomination marks were widely struck and widely circulated throughout Southern Italy and Greece in the intervening period, but rarely in so many different denominations. It is rare to see more than two or three different bronze denominations issued by any one mint at any one time. Rome's currency system stands out from other contemporary struck coinage particularly because of the number of fractions of the whole unit that were made. It would become the norm for many other *aes grave* coinages produced in Northern Italy, especially Etruria and Umbria.[26]

One of the oddities of the earliest three issues of Roman *aes grave* is that they don't *seem* to have the same target weight for the whole unit or *as*. Generally speaking, the *asses* of *RRC* 18 and 19 are heavier than those of the series *RRC* 14 by approximately 10–15 g. Crawford was worried about how the apparent weight standards between these early issues varied, but he did not come to any fixed conclusion about what it meant. Although he followed Thomsen's sequence, he particularly didn't like that *RRC* 18, which appears to be later in time, also seems intended to weigh more. He could accept weight decreases as an economic move, but the apparent temporary weight increase seemed to him less easy to explain.[27]

25 For example the coinage of Akragas, cf. SNG ANS 1029, or Himera, cf. SNG ANS 179–80.

26 Our evidence for dating these other series is highly inexact, but generally speaking we believe them to be later than the Roman series and to take their inspiration from Rome. The earliest of the non-Roman *aes grave* is likely to be the unattributed oval series (maybe from Volsinii?) Vecchi 196–201; other key examples of early non-Roman *aes grave* with pellets include those from Iguvium (Vecchi 203–15); Tuder (Vecchi 216–22); Tarquinii (Vecchi 120–7); and Volaterrae (Vecchi 128–34). There are also silver issues from Etruria that have denominations marks, likely struck at Pisa, Luca, and/or Populonia (HN Italy 95–101, 104–6, and 117–80).

27 *RRC* 1.44–5 esp. no. 3 and *RRC* 2.595.

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Crawford follows Haeberlin's assessment of relative weight standards for *aes grave*.[28] Haeberlin had collected data on far more specimens than are readily accessible for study today, and Crawford deferred to those numbers. Haeberlin derived his weight standard by applying a mean average to all his collected weights after excluding any specimens that he judged as outside his anticipated norms. Given our advances in statistical analysis over the last 100 years, it is worth revisiting Haeberlin's calculations to determine the validity of the weight standards he proposes.[29]

The reinvestigation of the published weights also allows us more accurately to describe the uniformity (or non-uniformity) of the data. Could a Roman or anyone else trust the face value of one of these coins? Did its face-value denomination communicate something meaningful about its weight? These questions are important for assessing the idea that these coins functioned as bullion or stores of raw material based on their weight.

Exploring data variability can be done both through data visualization (charts) and statistical analysis. Both are useful for trying to understand what level of variation might be historically meaningful. *Coinage of the Roman Republic Online* (*CRRO*) is an online, open access database documenting more than 60,000 coins from more than 50 collections. The weights recorded there are those reported directly by each major collection. *CRRO* represents the best aggregate of modern data, while many specimens recorded in *CRRO* were also observed by Haeberlin. Throughout the following sections, I report both *CRRO* and Haeberlin numbers. Haeberlin had access to far more material, but *CRRO* numbers are verifiable in a way that Haeberlin's are not.

6.3 *RRC* 14 Analyses

Table 6.2 displays a wide range of statistical data on the reported weights of coins in the series *RRC* 14. Most of these ways of describing the information help us think about how consistent the weights of individual specimens are in relationship to what the target weight may have been and help us see if there was in fact a consistent target weight for the whole issue and/or within each denomination.

[28] Haeberlin 1910.
[29] For the use of statistics to explore the weights of bronze coins, cf. Bransbourg 2011.

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Table 6.2 *Comparison of* CRRO *and Haeberlin weights for* RRC *14/1 by denomination*[*]

Type	*RRC* 14/1 (*as*)		*RRC* 14/2 (*semis*)		*RRC* 14/3 (*triens*)		*RRC* 14/4 (*quadrans*)		*RRC* 14/5 (*sextans*)		*RRC* 14/6 (*uncia*)		*RRC* 14/7 (*semuncia*)	
Data source	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.
No. of specimens	20	95	20	108	41	160	31	136	42	202	14	102	7	75
Mean (‘average’)	316.3	317	158.2	159.9	101.8	106.1	76.1	80.4	51.6	54.7	25.3	26.77	17.6	17
Median (‘midpoint’)	319.7	319	162	159.1	101	105.5	77.3	80	51.2	53.5	24	26.1	17.4	17.15
Standard Deviation	29.9	24.4	14	11.6	14.6	10.2	9.5	6.9	72	6.4	4.6	4.1	3.5	3.22
Relative SD	9%	8%	9%	7%	14%	10%	12%	9%	14%	12%	19%	16%	20%	19%
Interquartile Range	29.27	27.19	15	13.6	13.2	11.4	7.7	8.9	7.6	7.6	5.4	4.7	3.9	4.4
Relative IQR	9%	9%	9%	9%	13%	11%	10%	11%	15%	14%	22%	18%	23%	26%
Mean Absolute Deviation	15.97	13.69	7.7	6.9	6.9	5.6	4.5	4.5	3.7	3.7	2.5	2.39	2.1	2.1
Relative MAD	5%	4%	5%	4%	7%	5%	6%	6%	7%	7%	10%	9%	12%	12%

Prepared by the author.

* I have used a ‘relative’ IQR by dividing IQR by the median (the midpoint of the data), and a ‘relative’ MAD created by dividing the MAD by the mean (simple average). To the best of my knowledge, these are not widely applied statistical approaches but are mathematically and methodologically sound.

The relative standard deviation is a statistical method of comparing variance between different data sets.[30] In graph A of Chart 6.1, notice that weights reported by Haeberlin have a consistently lower degree of variance than those from *CRRO* – perhaps unsurprising given how many more specimens he observed and thus the greater strength of his sample size. Generally speaking, we find a greater variance among the weights of the smaller denominations. In historical terms, this means that the face value of a higher denomination *RRC* 14 specimen is significantly more likely to conform to the notional weight standard than that of a small denomination. To put this another way, we can see that the mint took far less care to control the weight of small denomination coins than it did for larger denominations. The *triens* however does not seem to fit the overall pattern, as it shows greater variation than the quadrans, possibly because it may have been produced in greater numbers than the quadrans. The standard deviation is more influenced by outliers in the data than other statistical measures of variability. We can use these other measurements as a check on the validity of any assertions based on this statistic. One such alternative measure is Interquartile Range, which assesses the size of the range into which the middle 50 per cent of the data falls. Graph B of Chart 6.1 shows a very similar pattern, adding confidence in our conclusion that less care was taken to control the weights of small denominations, and that, again, the *triens* shows greater weight variation than the quadrans. Chart 6.2 graphs the 'relative' Mean Absolute Deviation, a third approach for measuring the variability in the data. The Mean Absolute Deviation calculates the average distance of the individual data points from a particular point, in this case the mean (simple average). Like the Interquartile Range illustrated in Chart 6.1, Graph B, this the measure is less affected by outliers in the data. Again, the same pattern is visible: less variability in large denominations, greater variability in larger denominations. The trend lines are however more gradual, and for Haeberlin's data the *triens* here seems to fit the pattern. This warns us against concluding that the *triens* was actually cast with less care than the *quadrans*.

Were all the denominations aiming at the same or at least a similar weight standard?

To answer this question, I have multiplied each mean and median by the fraction of the full unit which the denomination represents: the *semuncia* was multiplied by twenty-four, the *uncia* by twelve, the *sextans* by six, and

[30] Another name for this calculation is the coefficient of variance; it is calculated by dividing standard deviation by the mean (simple average).

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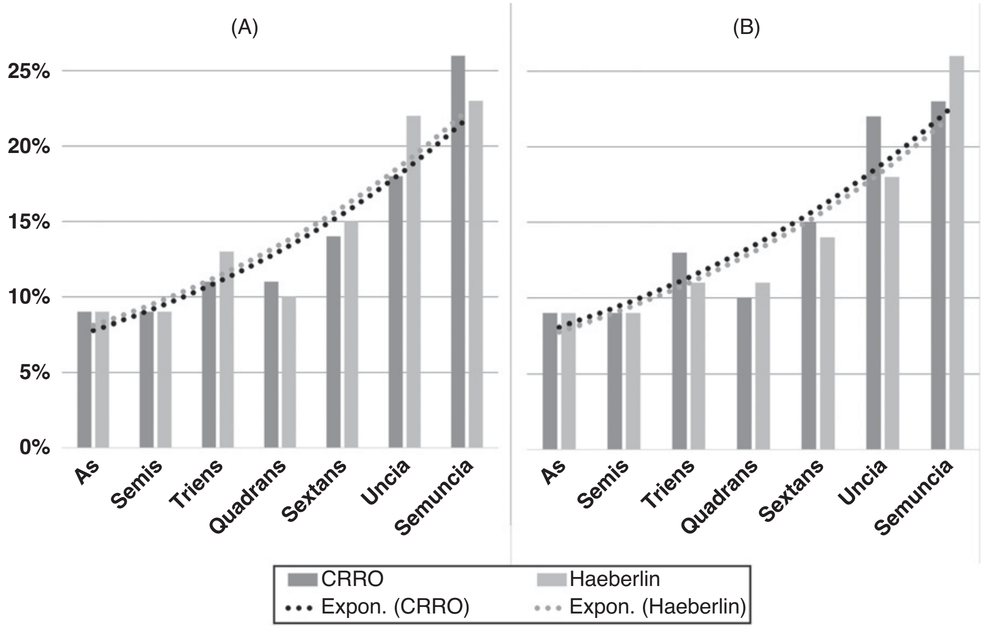

Chart 6.1 A-B: Relative standard deviations (A) and relative interquartile ranges (B) of *RRC* 14 weights as reported in *CRRO* and Haeberlin.
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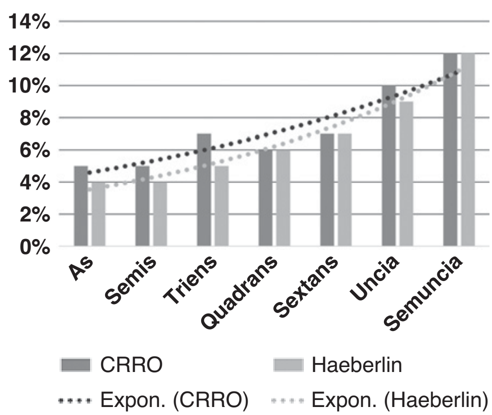

Chart 6.2 Relative mean absolute deviations of *RRC* 14 weights as reported in *CRRO* and Haeberlin.
Prepared by the author.

so on. The table records the results. As one can readily see, the *semuncia* produces a full unit equivalent much, much larger than any of the other denominations, perhaps because of the technical limitations of casting such

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a very small denomination. Haeberlin's specimens would suggest the full unit average weight was between 317 and 328.2 g, with the *sextans* resulting in the heaviest full unit and the *as* the lowest. *CRRO*'s data on the other hand produces a range between 303.6 and 316.4 g, with the *as* and *semis* giving the heaviest full unit average weights and the *uncia* the lowest. The mean (simple average) is, however, a poor tool for determining the possible original target weight.

Histograms are one means of visualizing the weight distributions of individual specimens of each denomination. The shape of data changes depending on the number of 'bins'. Each bin is the same size as every other bin on the same histogram; more bins mean narrower bins and a finer-grained analysis. The more data points within a particular bin, the higher that bin on the chart. The selection of number of bins is, in and of itself, an interpretive choice and the comparison of histograms of the same data set but with different numbers of bins can suggest different patterns.

In Chart 6.3, Graphs A and B both show the weights of the ninety-five specimens of *RRC* 14/1 reported by Haeberlin, the only difference is that A uses ten bins and B twenty bins. The ten-bin histogram (Chart 6.3, Graph A) shows the strong tendency for weights to be in this 304–336 g range, but the twenty-bin histogram (Chart 6.3, Graph B) helps us see better that steep drop-off after 344 g. In histograms we see that there is a more gradual

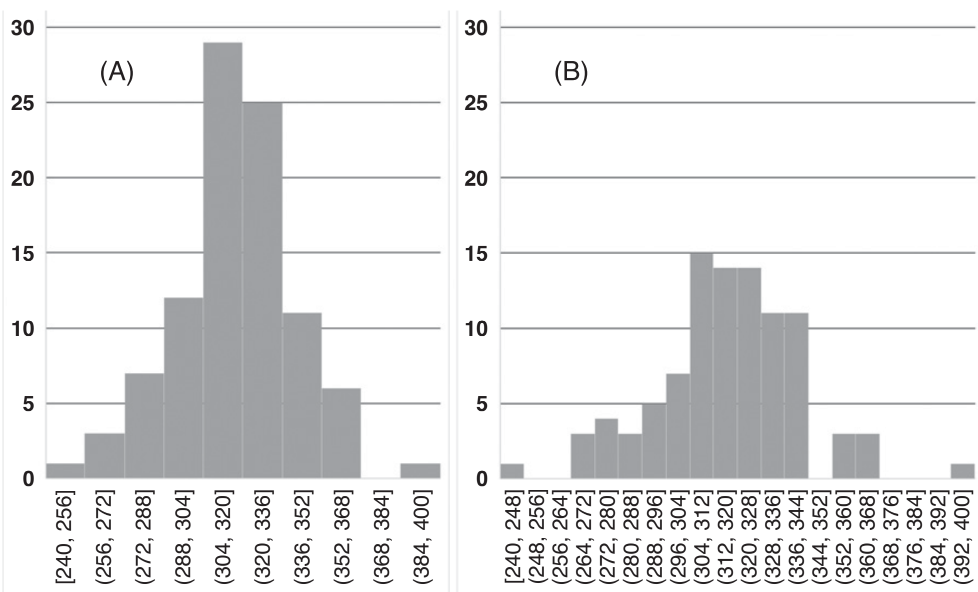

Chart 6.3 Ten-bin (A) and twenty-bin (B) histograms of the *RRC* 14 as based on Haeberlin. Prepared by the author.

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distribution of lower weight specimens but also that not only do the weights drop off sharply, but overweight specimens are more likely to be true outliers.

Chart 6.4 shows the weight distributions of specimens of the *semis* to *uncia* of *RRC* 14. The number of bins used in each of these five histograms is my own interpretative choice. While exploring the data, I experimented with any number of bins for each data set, going as low as four and as high as thirty. I selected for illustration for each denomination the number of bins that showed the most pronounced peak followed by a noticeable drop. The goal is to illustrate the distribution around the peak but also to use that peak as a potential indicator of the typical or target weight of the denomination. In the interests of space, histograms of the *CRRO* data are not illustrated, but the observed results are reported by way of comparison.

Based on these histograms, one can describe the typical and likely target weight of each denomination as follows. The numbers in parentheses are the upper and lower ranges suggested by histograms of the *CRRO* data for comparison purposes.[31]

The first thing this table (Table 6.4) demonstrates is that the *semuncia* is a significant outlier and cannot be meaningfully fit into a typical weight range for the full unit, as is the case with the other denominations. This raises questions as to whether a single weight standard was ever intended to apply to all denominations. However, if we allow that the *semuncia*'s status as an outlier might be due to challenges in the manufacturing process, we can look for a range applicable to the other denominations. This next table (Table 6.5) summarizes possible target ranges and to which denominations they fit the observed evidence.

A range of 316–324 g could apply to all denominations (except the *semuncia*, cf. Table 6.3) and thus might be considered the best fit if we want to assume that the target full unit equivalents were intended to be the same across all denominations. However, the significant variability in the data for the smaller denominations observed above (cf. Charts 6.1–2) would make it reasonable to question whether not only the *semuncia* but also the *uncia* forms a good indicator of the original unit applied to the series as a whole. Again, the smaller units reveal greater difficulty in assessing uniformity. Excluding the *uncia*, we might consider the typical range for *RRC* 14 to be circa 316–330 g.

[31] For the histograms of the *CRRO* data I used a six-bin for the *semis*, ten-bin for both *triens*, and eight-bins for both *quadrans* and *sextans*. The *CRRO* uncia histograms were largely inconclusive, but numbers from the six-bin are given. *CRRO* only has six specimens of the *semuncia*: too few to make a meaningful histogram.

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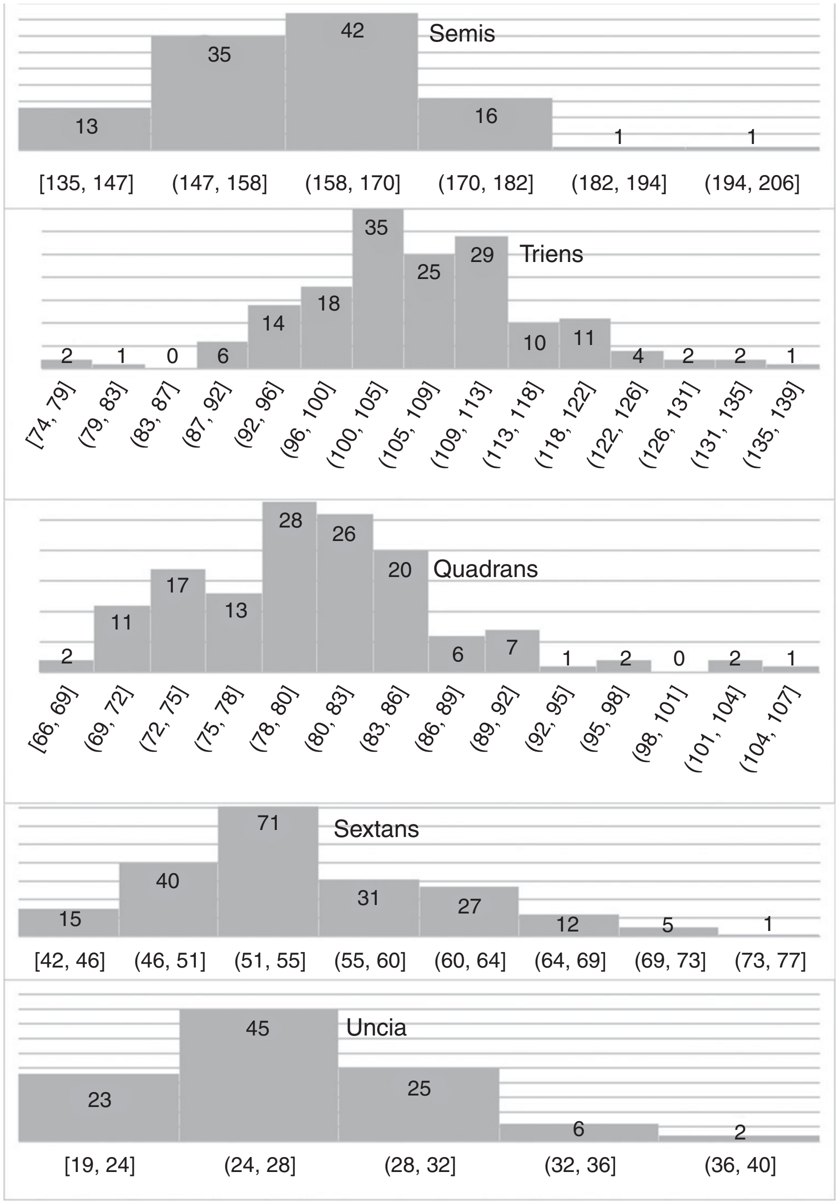

Chart 6.4 Histograms of *semis* through *uncia* for *RRC* 14 based on Haeberlin. Prepared by the author.

How is this different than Crawford's reported weight standard of circa 322 g, or why might it be better than using the range of mean weights, 317–328 g (cf. Table 6.3)? First and foremost, it acknowledges the lack of precision we observe in the objects themselves. The Romans were certainly capable of producing

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Table 6.3 *Comparison of* CRRO *and Haeberlin mean and median weights for* RRC *14/1 by denomination, standardized by denomination*

Type	*RRC* 14/1 (*as*)		*RRC* 14/2 (*semis*)		*RRC* 14/3 (*triens*)		*RRC* 14/4 (*quadrans*)		*RRC* 14/5 (*sextans*)		*RRC* 14/6 (*uncia*)		*RRC* 14/7 (*semuncia*)	
Data source	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.
No. of specimens	20	95	20	108	41	160	31	136	42	202	14	102	7	75
Mean ('average') as full unit equivalent	316.3	317	316.4	319.8	305.4	318.3	304.4	321.6	309.6	328.2	303.6	321.2	422.4	408
Median ('midpoint') as full unit equivalent	319.7	319	324.0	318.2	303	316.5	309.2	320	307.2	321	288	313.2	417.6	411.6

Prepared by the author.

Table 6.4 *Summary of typical weight ranges of* RRC *14 denominations as observed using histograms (Charts 6.3–4)*

Denomination	Lower end of range	Upper end of range	Full unit equivalents	
As	304	336	304	336
Semis	158 (160)	170 (170)	316	340
Triens	100 (99)	113 (108)	300	339
Quadrans	77 (76)	86 (82)	308	344
Sextans	50 (48)	55 (56)	300	330
Uncia	24 (22)	28 (25)	288	336
Semuncia	16	20	384	480

Prepared by the author.

Table 6.5 *Summary of possible typical full unit weight ranges for* RRC *14/1 and the fit with each denomination*

Possible range (g)	As	Semis	Triens	Quadrans	Sextans	Uncia
304–324					X	X
308–328		X	X	X	X	
308–336	X		X	X		
316–324	X	X	X	X	X	X
316–330	X	X	X	X	X	
316–336	X	X	X	X		
316–340		X	X	X	X	

Prepared by the author.

objects all conforming to a fixed standard in this period. That they chose not to prioritize conformity is a significant finding. Reporting the weight standard as a typical range of 316–330 g or 316–324 g helps reveal the amount of imprecision the Romans were willing to accept in their new monetary system. Ten to fifteen grams or 3–5 percent of the target weight of the *as* was ‘close enough’. This ‘close-enough’ attitude and the inability to fit the *semuncia* into a weight standard that could be shared by the rest of the series further problematizes the idea that *RRC* 14 was intended to circulate as bullion based on intrinsic value.

6.4 *RRC* 18 Analyses

This section is concerned with similar questions as the last: How much variation is in the reported weights of what is traditionally understood as the second series of heavy bronze, *RRC* 18, and is it possible to find a typical

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or even target weight range for the series or its denominations (cf. Tables 6.6–7)? We can also use this approach to assess Thomsen's determination of the relative chronological relationship of *RRC* 14 and 18 based on assumptions about their respective weight standards.

By all statistical measures (Charts 6.5–6), the smaller denominations of *RRC* 18 show increased variation, just as we saw with *RRC* 14. Thus it seems fair to conclude that less care with regard to conformity to a weight standard was taken in the manufacture of the smaller denominations of Rome's earliest *aes grave*

The comparison of the variation of coins in series *RRC* 14 and *RRC* 18 provides a good reminder that statistical analysis is only as good as the available data. Looking at both interquartile range (IQR) and mean absolute deviation (MAD), *CRRO* data reveals more variation for *RRC* 18 than *RRC* 14, whereas Haeberlin's data shows the reverse with less variation for *RRC* 18 than *RRC* 14. Both cannot be true of the original population, by which I mean all coins originally made. One dataset *must* be a more accurate reflection of that original population than the other. The differences in the patterns expressed by data from *CRRO* and Haeberlin are also problematic when trying to test whether or not *RRC* 18 was intended to conform to a higher weight standard than *RRC* 14, a fact thus far widely accepted by scholarship. Chart 6.7, Graph A illustrates that this is true for the Haeberlin data in general, but the degree to which *RRC* 18 specimens have a higher mean weight than *RRC* 14 specimens varies greatly by denomination. Chart 6.7, Graph B illustrates the *CRRO* data and shows far less consistency. It is notable in both instances that the *quadrans* has a mean weight that is so much higher than other denominations.

As in the last section, data for *RRC* 18 can also be visually analysed by the use of histograms. The following charts are based on Table 6.8 and unillustrated histograms of *CRRO* data (cf. Chart 6.8). For all denominations a typical weight range of 324–336 g for the full unit is observed. Crawford suggests a target weight of 'about 334 gr.' for *RRC* 18, but this seems high given the available data. If we measure it against the mean weights for each denomination as reported by Haeberlin (Chart 6.7, Graph A), we find a mean average deviation of 6.66.

We can also notice how closely the typical weight ranges for all denominations correspond for both *RRC* 14 and 18 (see Table 6.9). While on average *RRC* 18 specimens do seem to be slightly heavier than *RRC* 14, the data patterns do not suggest that this was necessarily a very meaningful difference as both issues produced specimens that significantly differed from any apparent target or weight standard. If we wanted to describe the

Table 6.6 *Comparison of* CRRO *and Haeberlin weights for* RRC *18/1 by denomination*

Type	*RRC* 18/1 (as)		*RRC* 18/2 (*semis*)		*RRC* 18/3 (*triens*)		*RRC* 18/4 (*quadrans*)		*RRC* 18/5 (*sextans*)		*RRC* 18/6 (*uncia*)	
Data source	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.
No. of specimens	20	75	29	100	28	111	32	132	30	163	27	105
Mean ('average')	316.8	339.2	153.7	162.5	106.2	111.0	78.1	81.8	54.9	56.6	25.4	27.4
Median ('midpoint')	324.3	339.1	153.4	163.2	103.7	110.7	79.2	82.6	54.4	55.0	25.4	27.3
Standard deviation	25.2	15.1	13.9	12.2	11.1	7.9	10.5	9.4	8.9	6.5	4.8	3.2
Relative SD	8%	4%	9%	7%	11%	7%	13%	11%	16%	12%	19%	12%
Interquartile range	32.2	21.3	19.2	16.0	11.2	10.5	10.8	8.7	6.8	8.5	6.1	4.0
Relative IQR	10%	6%	13%	10%	11%	9%	14%	11%	13%	15%	24%	15%
Mean Absolute Deviation	16.1	11.3	9.6	7.4	5	5.2	6	4.2	4.7	3.6	3.2	2.3
Relative MAD	5%	3%	6%	5%	5%	5%	8%	5%	9%	6%	13%	8%

Prepared by the author.

Table 6.7 *Comparison of* CRRO *and Haeberlin mean and median weights for* RRC *18/1 by denomination, standardized by denomination*

Type	*RRC* 18/1 (*as*)		*RRC* 18/2 (*semis*)		*RRC* 18/3 (*triens*)		*RRC* 18/4 (*quadrans*)		*RRC* 18/5 (*sextans*)		*RRC* 18/6 (*uncia*)	
Data source	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.	*CRRO*	Haeb.
No. of specimens	20	75	29	100	28	111	32	132	30	163	27	105
Mean ('average') as full unit equivalent	307.4	325	318.6	333	312.4	327.2	329.4	339.6	304.8	328.8	307.4	325
Median ('midpoint') as full unit equivalent	306.8	326.4	311.1	332.1	316.8	330.4	326.4	330	304.8	327.6	306.8	326.4

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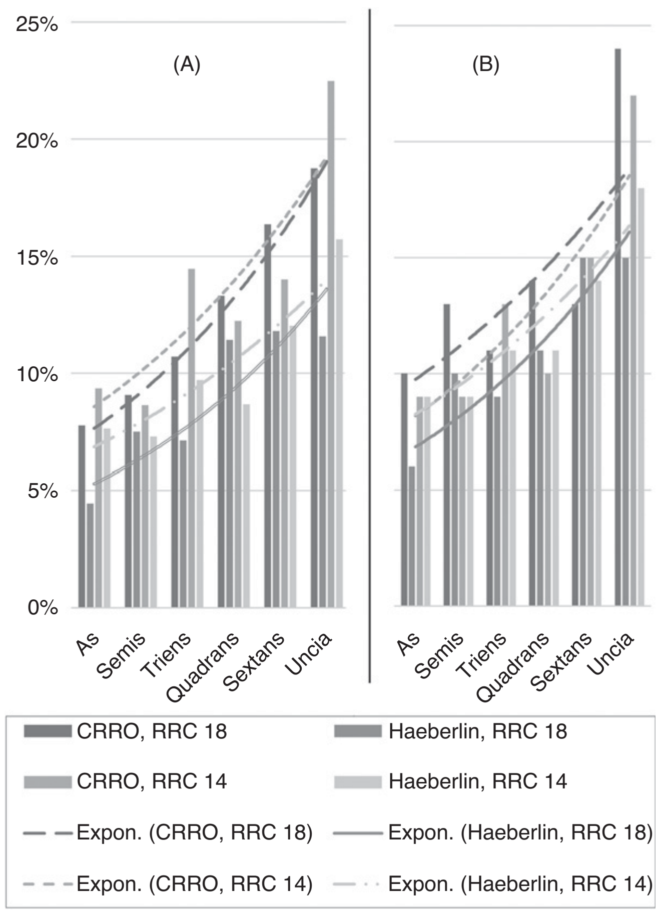

Chart 6.5 Comparisons of *RRC* 14 and 18 as reported in *CRRO* and Haeberlin showing (A) relative standard deviations and (B) relative interquartile ranges.
Prepared by the author.

weight range of both, we could comfortably describe them together as generally conforming to a 324 g ±12 standard. For *RRC* 18, Haeberlin's data produces a mean absolute deviation of 3.33 for each denomination's mean weight when measured against a 324 g weight standard, a 50 per cent better fit than for Crawford's 334 g number. The same calculation using the median weight of each denomination also produces a better fit, but only 6 per cent better. However, because of the exceptionally high variation in the data, these types of measure are not particularly meaningful. The most important point is that, even if there was a notional weight standard, this did not result in any great concern regarding uniformity of weights in the manufacturing process.

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Table 6.8 *Summary of typical weight ranges of* RRC *18 denominations as observed using histograms (cf. Chart 6.8)*

Denomination	Lower end of range	Upper end of range	Full unit equivalents	
As	324 (323)	348 (343)	324	348
Semis	161 (148)	170 (166)	322	340
Triens	102 (100)	116 (105)	306	348
Quadrans	80 (78)	87 (84)	320	348
Sextans	52 (52)	56 (58)	312	336
Uncia	25 (24)	30 (29)	300	360

Prepared by the author.

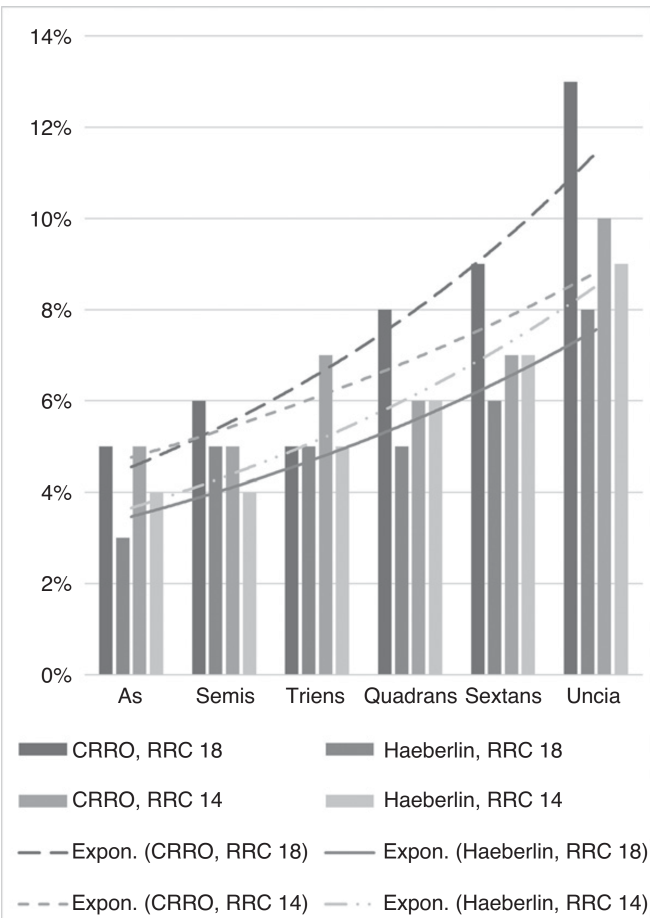

Chart 6.6 Comparison of *RRC* 14 and 18 as reported in *CRRO* and Haeberlin showing relative mean absolute deviations.
Prepared by the author.

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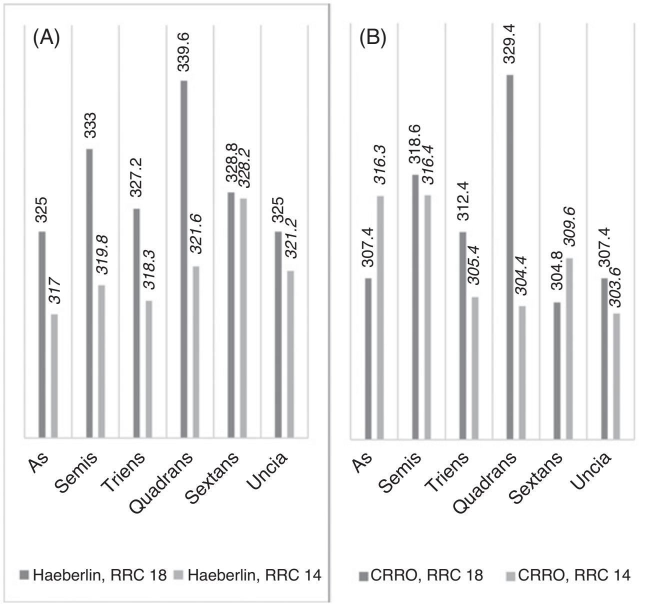

Chart 6.7 Mean weights by denomination as reported by Haeberlin (A) and *CRRO* (B). Prepared by the author.

6.5 *RRC* 19 'Analyses'

One cannot really analyse coins of the third series of heavy bronze (*RRC* 19) in this same manner because of the small number of recorded specimens. There is only one known specimen of the *as* from the Santa Marinella hoard (330.70 g). For the *semis*, we have three examples recorded by Haeberlin (170.17 g, 164.49 g, and 161.05 g) and one more gifted to the American Numismatic Society (ANS) in 1944 (161.04 g). These five specimens suggest 329 g might have been the average full unit weight, with a standard deviation of 7.5 (2.3 per cent) and mean absolute deviation of 6.8 (2.1 per cent). All known specimens could fit well within the typical weight ranges observed using histograms of *RRC* 14 and 18 data.

6.6 Historical Implications

Based on the preceding statistical analyses of *RRC* 14 and 18, I am comfortable with a generalizing statement that both coin series were conceived of in antiquity as conforming to a system where an *as* was equal to a Roman pound. This was likely also true of *RRC* 19, although there is too little evidence to be certain. Even if *RRC* 18 tends to be slightly heavier than *RRC* 14, this turns out

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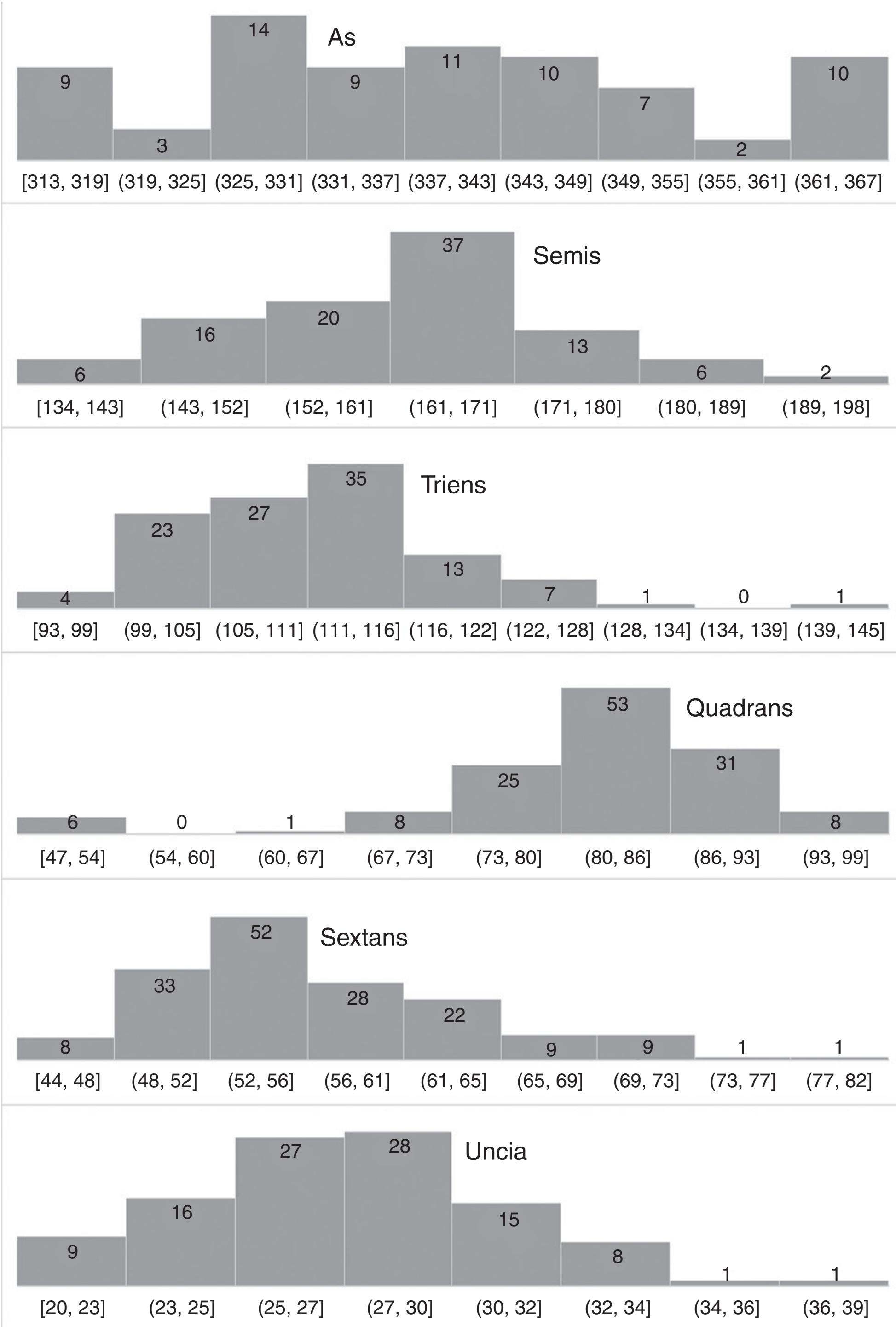

Chart 6.8 Histograms of *as* through *uncia* for *RRC* 18 based on Haeberlin. Prepared by the author.

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Table 6.9 *Summary of typical weight ranges of* RRC *14 and 18 denominations compared (cf. Tables 6.4 and 6.8)*

	RRC 18		*RRC* 14	
	Lower end of range	Upper end of range	Lower end of range	Upper end of range
As	324 (323)	348 (343)	304	336
Semis	161 (148)	170 (166)	158 (160)	170 (170)
Triens	102 (100)	116 (105)	100 (99)	113 (108)
Quadrans	80 (78)	87 (84)	77 (76)	86 (82)
Sextans	52 (52)	56 (58)	50 (48)	55 (56)
Uncia	25 (24)	30 (29)	24 (22)	27 (25)

Prepared by the author.

to be a very slight and arguably insignificant difference. The designation of *RRC* 18 (and *RRC* 19) as a 'supralibral' standard in contrast to the libral standard of *RRC* 14 should be abandoned. Given that it was this supposed 'supralibral' quality that led Thomsen (followed by Crawford) to date *RRC* 18 and 19 later than *RRC* 14, we can no longer support this chronological seriation on these grounds. It would be better to assign all three series to approximately the same period, some time in the decade prior to the First Punic War, and remain agnostic about resolving their sequence further until better evidence or hoard data emerges.

The other major conclusion is that conformity of the individual specimens to a precise standard does not seem to have been a production concern. For individual specimens of *RRC* 18, for example, the full unit equivalent of their weight could be anywhere between circa 290 and 370 g, and the specimen could still be said to fall within the observable norm. Likewise, for individual specimens of *RRC* 14 the full unit equivalent of their weight could be anywhere between circa 290 to 345 g, and the specimen could still be said to be within the observable norm. Chart 6.9 illustrates this using a box and whiskers diagram. The box contains 50 per cent of known specimens, the line through the box represents the median, and the cross marks the mean. The whiskers show the extent of the data, and the dots outliers.

These coins therefore reveal considerable variation such that we should question whether the type and degree of variation in weight was meaningful to the function or sociohistorical value of these coins. A practical explanation for the variation we observe is identifiable in the casting process, which controlled for diameter, not weight. The channels through

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which molten bronze was poured into moulds created branches or 'spues'. When the newly cast coin was broken off the branch, the break produced a very visible indentation or protrusion on almost all specimens. The depth of the carving of the design in each individual mould would also affect the volume of metal in the individual specimen, even if the diameter of each mould was the same. The Romans could manufacture with precision, as their contemporary struck coinage would confirm, but it was apparently not a concern to control this casting process to achieve more uniform results. With the *aes grave*, it was easier and seemingly acceptable for the intended purpose to manufacture a highly variable final product.

As mentioned in the first section of this chapter (Section 6.1), we assume that these early cast Roman bronzes were intended to suit the needs of populations habituated to the use of *aes rude* or *aes formatum* as money. In archaeological contexts, primarily votive deposits, we find very small pieces of *aes rude*. The thirteen specimens recovered from Nemi range from 13.39 g to 211.1 g, but with most falling under 45 g and about one third under 20 g.[32] Reports of *aes rude* from Vicarello on deposit at the Vatican have specimens in the 11–43 g range.[33] There are also many very small specimens of *aes rude* in museum collections but without archaeological context.[34] The existence of very small pieces of *aes rude* suggests that it may not have been uncommon for transactions done by weighing these pieces to be precise down to measurements as small as 10–20 g. But if such accuracy was a goal, this makes the variation seen in early Roman *aes grave* denominations harder to understand on a bullion-based model. With small but heavy denominations such as the *semuncia*, it may have been more costly in raw-material terms to produce these coins than their denominational face value.

Why then make such heavy cast coins? Would not adopting smaller struck coinage be more convenient? The answer is probably not economic, but rather cultural and social.[35] *Aes rude* and *aes formatum* were widely used monetary instruments, which served as means of storing wealth, measuring value, and conducting exchange. As valued objects we often find them deposited as religious offerings as well. Roman *aes grave* is heavy because it serves the monetary needs of peoples acculturated to heavy bronze money, but that does not directly follow that they conceived of bronze monetary objects as raw materials or commodities.

32 Crawford 1983.

33 Tocci 1967–8. Large finds are also known in religious contexts: at Pyrgi, a pot hoard of *aes rude*, likely a ritual deposit connected to a nearby altar, contained five very large pieces ranging from 152.61g to 760.2 g (Drago Troccoli 2013).

34 For example, more than two dozen weighing under 20 g at the BnF.

35 Cf. Bernard 2018b.

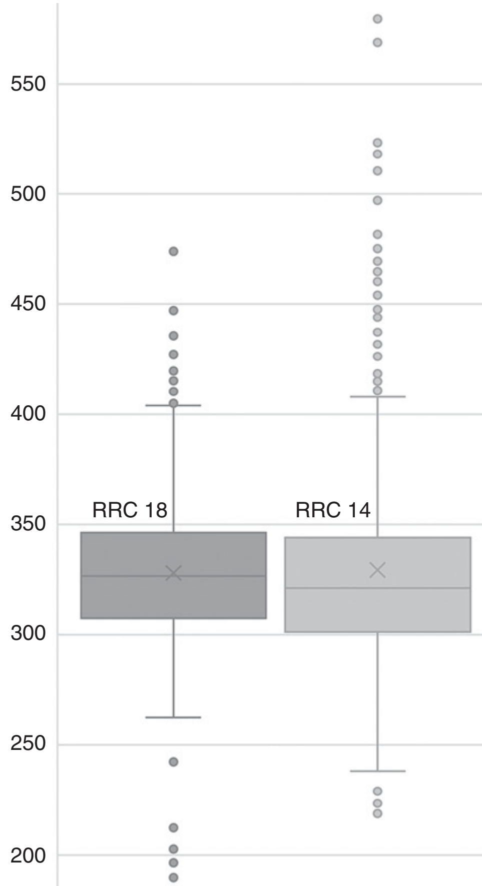

Chart 6.9 Box and whisker chart showing Haeberlin weights for *RRC* 18 and *RRC* 14 with fractional denominations given as their full pound equivalents.
Prepared by the author.

As to the question of why the early issues had such a complex denomination system, it may be that the *aes rude* and *aes formatum* already had some form of denomination system in place. New work statistically analysing the weights of hacksilver, seemingly unstandardized pieces of silver commonly found at Near Eastern Bronze Age sites, has demonstrated that individual pieces indeed tended to conform to known weight standards and that the individual pieces likely circulated as a 'bullion-currency' or what we might call pseudo-denominations.[36] Similar analysis of *aes rude* may reveal that it shows tendencies to conform to local weight standards, and more research is needed.

[36] Ialongo, Vacca, and Peyronel et al. 2018.

What does all this mean for the historian? Rome's *aes grave* is strange, and perhaps stranger than we have appreciated to date. It does not seem to have been valued as bullion, but rather as a symbolic monetary object. At the point of manufacture, we can say that Rome wanted its bronze money to look like coinage but still wanted it to conform in weight variability to its antecedents. This conclusion should serve to destabilize some of our ideas about the fixed nature of exchange in this period and aligns well with the more fluid economic picture painted by Tan in Chapter 3. This is not because the specific metal content itself gave it value, but because the heft of the individual pieces was a cultural norm, one not easily set aside. Ultimately, this ends up being a vindication of Burnett's hypothesis that the Romans applied the circular shape and double-sided design of Greek coinage prevalent in Southern Italy to the Central and North Italian tradition of using cast bronze as monetary instruments.[37] The important caveat is that the weight standards (such as they are) and denominational system are likely an outgrowth of the pre-existing monetary habits of the region.

37 Burnett 1989: 55–7.