For good measure. The control of measuring instruments in the ancient Greek market

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Abstract:

This paper focuses to the control of measurement instruments and the intervention of public authorities in this process. I will present a synthesis of the knowledge on the subject, the main sources available to us, as well as the questions that remain unanswered. I will first examine the intervention of public authorities during the production phase and then during the use phase of these instruments. I will pay particular attention to the case of Classical and Hellenistic periods, which are particularly well-documented.

Keywords: Weight, Measuring instruments, Historical metrology, Athens, Agora

In ancient Greece, but also elsewhere, the use of measuring instruments in trade was governed by a series of regulations. Providing a legal, material and administrative framework helps to ensure proper functioning of trade. Placing measuring instruments under state guarantee was one way to provide confidence in the measurement system. This involved the definition of standards and the standardization of measurements and systems. On the one hand, the ancient Greek city supervised the manufacture, conservation, reproduction and diffusion of standard and official measurements. On the other hand, the city appointed magistrates to control and intervene in order to punish fraudsters and ensure the accuracy of the use of measuring instruments in commercial transactions. The main question is how far this state intervention extended.

Standardization and regulations

We know that customs, laws and decrees prescribed the type of goods to be weighed, the quantity, the places, the circumstances and the methods of weighing. Unfortunately, we have few primary sources available to study these regulations. In addition to this, the obligations of merchants probably varied according to the context (wholesale or retail, auction or stall), the place of sale (agora, *emporion*, *panegyria*,[1] shops, workshops, warehouses, etc.),[2] but also the nature (perishable or non-perishable goods) and particularly the strategic nature of the goods (wheat, bread, wool, wood), and it also changed over time.

Goods sold by weight were only a part of the many goods offered by merchants on the agora, which could also be measured by volume of dry capacity (such as grain, dried fruits, flour, and legumes) or liquid capacity (such as oil and wine), or counted by the piece or by the pair. These measuring habits were not fixed, as some commodities could be measured differently depending on the context.[3] It remains to be determined what the circumstances and reasons are for choosing one the choice of one measurement method over another.

Several epigraphic sources attest to the sale by weight of meat,[4] fish,[5] wool,[6] metals,[7] wood, coal,[8] or bread.[9] These goods nevertheless call for different orders of magnitude, and therefore different measuring instruments (scales, weight sets, etc.). It is likely that other specific weighing uses existed depending on the type of goods involved. The predominance, within the

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[1] An inscription from Andania in Messenia (*IG* V 1, 1390, in particular l. 99–111), dated to the beginning of the first century BC, provides valuable information on the organization of commercial activities during sacred festivals, such as the Mysteries, and on the role assigned to the *agoranomoi* in this matter. On the importance of the commercial exchanges during *panegyries*, see Chandezon 2000.

[2] Numerous literary, epigraphic, and archaeological evidences attest to specific locations for the sale of certain goods. On the different types of sales, products, and locations associated to them, see Karvonis 2007 and the many references cited by him. On auctions, see also Moretti *et al.* 2012, 237–41.

[3] Grain was typically measured by volume of dry capacity, but variations in density and quality, or simply the greater convenience offered by weighing operation for large quantities of goods, sometimes prompted the Athenians to weigh them (*SEG* XLVIII, 96, l. 21–25; Van Wees 2013, 119, 124–25; Fantasia 2004, 535; Stroud 1998).

[4] An agoranomic inscription from Piraeus (*SEG* XLVII, 196), dated to the second half of the first BC, presents a price list of tripe pieces (pork, goat, sheep, beef) and mentions weighing by the mina with a scale stand (ζυγόστασις). Other sources mention the weighing of meat: Herodotus (II, 168) alludes to the weighing of pieces of beef counted at the mina; Theophrastus (*Char.*, 9, 4) and an inscription from the island of Ceos (*IG* XII, 5, 647, l. 15), dated to the beginning of the third century BC, also refer to the weighing of the meat.

[5] An inscription from Akraiphia in Boeotia (*SEG* XXII, 450), dated to the years 224–210, mandates the use of the city's official weights for the sale of fish, the prices of which are listed "by the mina." See especially Roesch 1974; Salviat and Vatin 1971; Feyel 1936.

[6] A law from Erythrai (*I.Erythrai* 15), dated to the fourth century BC and regulating the wool trade, refers to the weighing of wool.

[7] Among numerous attestations, an account of the cult statues of the Hephaisteion dated from the last quarter of the fifth century BC (*IG* I[3] 472 [421/400-416/415], l. 139-145) mentions prices for copper and tin, measured in talents. Lead was also measured in talents, as in the accounts of the Erechtheion (*IG* I[3] 476, fr. XVII, col. II, l. 296–299), dated 408/407, or several accounts of Delos dated to the third century BC (*IG* XI, 2, 153, l. 13 and 203, A, l. 34–35, 52, 71-72). A naval inventory of the fifth century BC (*IG* II[2] 1627 [330/329], l. 282–283, 290–299, 311-312) still mentions iron measured in minas.

[8] Chankowski (2012, 36) demonstrated that in the Delian law on the sale of wood and coal (*ID* 509 = *SIG*[3] 975), dated to the second half of the third century BC, the word σταθμοί (l. 2, 33-34) referred, not to weights as such, but to specific sale locations made available to merchants and buyers. On the other hand, the accounts of the hierops (*e.g.*, *ID* 290, l. 48, 66) do mention the weighing of wood by talent. Wood could also be measured in cubits (πήχεις), or counted by the unit when, for example, beams or boards were involved.

[9] Hdt., II, 168; Xen., *Symp.*, II 20; *Ath. Pol.*, 51, 3. The Athenian law on taxation of grain (*SEG* XLVIII, 96, l. 16–17, 21–25, 40–41), dated 374/373 BC, also refers to the weighing of grain (see Fantasia 2004; Stroud 1998).

corpus of Athenian commercial weights, of weights with a mass of between *c.* 50 g and 350 g fits well with the evidence of weighing for certain foodstuffs (meat, fish, bread, etc.) (Willocx 2020).

The Athenian decree, dated to the end of the second century BC, is currently our best source for knowing the administrative and legal framework for the creation and preservation of metrological standards and the reproduction of official copies. The decree ensures the supervision of the city in the production of measurements. The inscription says that a public official is responsible for overseeing the whole process; he delegates to public slaves the production of the official copies (σηκώματα) and the conservation of the standards (σύμβολα), which are kept with the greatest care in public buildings, located in the main trading places and sacred places of the city: the Skias or Tholos on the Agora, in Piraeus and in Eleusis (*IG* II^2 1013, l. 38–40, 54–55). Finally, a set of standards was placed on the Acropolis.[11] The official copies were made available to magistrates and private individuals who could use them as reference and control measures in the market.

At the end of their term of office, the public slaves had to pass on the weights and measures standards to their successors with an inventory and they had also to replace lost or destroyed weights and measures at their own expense. The inventory had to be deposited in the Metrôon, the temple dedicated to Mother Goddess which houses the official archives of the city. This procedure is confirmed by an inscription dated 222/221 BC (*SEG* XXIV, 157. See Vanderpool 1968), which contains a list of the weights and measures transmitted by the magistrates called *metronomoi* leaving office to their successors.

However, the Athenian decree *IG* II^2 1013 does not specifically name the magistrates responsible for production of measuring instruments, but only refers to them by the vague terms ἄρχοντες (l. 3–4, 6, 12, 57, 64) or ἀρχαί (l. 7, 11, 27, 41, 66).[13]

The provision of official weights

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[11] The deposit of reference measurements in sacred places was probably intended to give them a divine guarantee and inviolability.

[13] According to Oliver (2012, 86), the decree does not clearly mention any magistracy because the period between the second century and the end of the first century BC is a transitional period during which the supervision of measuring instruments was temporarily assumed by the *astynomoi*. But it is also possible that these generic terms were deliberately chosen to encompass all magistrates with functions related to weights and measures on the agora (Fantasia 2012, 31). And it is also not out of the question that the competent magistrates were explicitly mentioned in the unpreserved parts of the decree (Rizzi 2014, 57–59).

The obligation to use conforming weights and measures is a recurring *topos* in Greek literary and epigraphic sources related to market regulations.[14] Magistrates were responsible for providing merchants with measuring instruments and weights that conformed to the standards and they had to oblige traders to use the official and verified weights.[15]

Official measuring instruments, including public scales, were also made available to the general public. An inscription found in Piraeus (*SEG* XLVII, 196) refers to the weighing of commodities with the Greek term ζυγόστασις, which would refer to a scale stand from which the reference public scale was suspended. There, the *agoranomos* could carry out control weighings and adjust the measuring instruments used by the merchants.

However, the definition of the legal status of standards, official copies and private copies is a field of research that remains to be explored. Many Athenian but also Greek commercial weights (and other *instrumenta publica*) have the legend ΔΕΜΟ, for δε̄μό(σιον) "public", or have the ethnic of the city, which attest to the official and state-guaranteed character of these objects. However, these legends do not necessarily mean that the objects are the property of the city, but only that they are part of its administration and policy. Conservatism and the common use of consecrated *formulae* on official instruments are reflected by the common spelling of the legend ΔΕΜΟ, with an *epsilon* rather than an *eta* (Willocx 2022, 148–50).

It also remains to be seen whether the official commercial weights actually belonged to the city and were made available to the merchants, or whether the merchants had their own sets of weights. Indeed, the merchants were required to use measuring instruments corresponding to the official units but they did not necessarily have to use the measuring instruments provided by the magistrates, which served primarily as reference objects.

Magistrates

In most Greek cities, magistrates were appointed every year to supervise the general organization of transactions and maintain order on the market. One of their tasks was to check the metrological instruments used by merchants and punish those who did not use correct weights and measures. In most Greek cities, this was usually entrusted to magistrates called

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[14] See, among others, *ID* 509, l. 38-40; *IG* II[2] 1013, l. 17-18; *IG* V 1, 1390, l. 99-100; *Ath. Pol.*, 51, 2; Alcidamas, *Testimonies*, 27; Philo of Alexandria, *On Special Laws*, IV, 194.

[15] If the magistrates do not fulfill this function correctly, the decree *IG* II[2] 1013 (l. 12–13) specifies that they will be struck with a fine of 100 drachmas to be poured with the treasure of Demeter and Korè.

agoranomoi,[18] but other officials such as *astynomoi*, *hipparchoi*, *panegyriarchai*, *paraphylakes* or *eirenearchai* could also be assigned to this task.

In Athens, due to the size of the city and its commercial significance, different specialized colleges assisted the *agoranomoi* and shared responsibilities for trade. The *metronomoi* were particularly responsible for checking the scales and weights used by traders.

An inscription found on the Agora and dated 222/221 (*SEG* XXIV, 157. See Vanderpool 1968), attests to the transmission of standards and working instruments from one college of five *metronomoi* to another. The text also mentions that the *metronomoi* were assisted by two secretaries, one selected by lot (γραμματεὺς κληρωτός) and one elected (γραμματεὺς αἱρετός). However, the role of these secretaries remains poorly known. The inscription was discovered in the Southern Stoa I, a building that may have contained magistrates' offices, including that of the *metronomoi*.

In the Athenian sources of the imperial period, it is the *agoranomoi*, rather than the *metronomoi*, who are responsible for weights and measures. The first inscription to mention the competence of the *agoranomoi* in this field is the inscription of Piraeus on the prices of tripe, dated from the second half of the first century BC (*SEG* XLVII, 196).

Countermarks

There is still a lack of knowledge regarding the modalities (frequency, places, objects, persons, etc.) for the control of measuring instruments by the competent magistrates. These controls gave rise, in particular, to the stamping of countermarks on commercial weights and measures of capacity.

Our examination of the countermarks stamped on Athenian commercial weights demonstrates the close proximity between coins, weights and measures (Willocx 2022, 163–86). Indeed, the minting of coins, the stamping of amphorae or the countermarking of weights refer to similar techniques and meanings (Picard 2017; 1987). All these operations served to confer legal status on instruments of measurement and exchange. These marks were issued by a competent public authority and served to guarantee the quality and conformity of the objects but also to identify those responsible for their production and control. We generally find the

[18] On the responsibilities of *agoranomoi* in the Greek world in Classical, Hellenistic, and Roman times, see most recently Capdetrey and Hasenohr 2012; Boffo 2009; Bresson 2008, 22–27, 29–34; Migeotte 2005. See also ancient literary sources that mention the responsibilities of *agoranomoi*, among others, *Ath. Pol.*, 51; Pl., *Leg.*, VI, 764b and XI, 917e–918a and Theophr., fr. 98.

same types, symbols and legends on instruments from the same city. These symbols come from a common iconographic background and often refer to the protective deities of the city. In addition to these purely civic symbols, some countermarks probably represent the personal signs of magistrates. However, despite the many parallels between Athenian commercial weight countermarks and coin types, the size of the countermarks, the representation of the symbols and the arrangement of the legends clearly distinguish these marking operations from monetary minting and suggest a proper use of civic motifs on both instruments.

Destruction

Several commercial weights show evidence of being sheared, indicating the intervention of a public authority, probably the *agoranomoi* or *metronomoi*, to remove non-conforming objects from circulation. This practice is mentioned in the Athenian decree *IG* II^2 1013 (l. 29: κατακόπτω) and was also common for coins (see διακόπτω in the law of Nicophon [*SEG* XXVI, 72, l. 11–12], which entrusts a public slave with the function of *dokimastes*, i.e. to check the coins used in the market and to mark those that do not meet the quality requirements set by the city).[22] However, the criteria for declassification and the fate of these objects are unclear (confiscation, offering to the gods, recycling, remelting) and require further clarification.

Frauds

The control of magistrates in the market was one of mechanism for preventing fraud (Fantasia 2012). Different courts had jurisdiction, and various sanctions were foreseen depending on the nature of the offence and the status of the offender. Several textual sources mention regulations and sanctions related to metrological fraud.

The Athenian decree *IG* II^2 1013 mentions at least one type of fraud: the use of a larger or smaller container than the norm. The beginning of the text, which is unfortunately incomplete, also mentions a fraudulent measure and the legal sanctions applied. On the one hand, the goods offered for sale by the merchant are confiscated and auctioned and, on the other hand, the offending measure or instrument is destroyed. And if the offender is a slave, he will receive fifty lashes.

[22] The bibliography around this law is abundant. See, among others, Engen 2005; Figueira 1998, 536–47; Martin 1991; Stumpf 1986; Buttrey 1981; Stroud 1974.

Seizure and auction are types of sanctions attested elsewhere, such as in the inscription from Erythrai on the wool trade (*I.Erythrai* 15, l. 14–23), which orders that the goods of sellers who do not use the public scales be sold by auction.

Among the Athenian weights, some examples of countermarks stamped on the reverse side of the weights exist (Willocx 2022, 168). It was probably a way to prevent the removal of material from the surface and therefore a technique to prevent fraud attempts.

In addition to fraudulent weights and measures, these sanctions could perhaps also apply to fraudulent behavior, such as the incorrect and fraudulent use of correct measuring instruments. This could be the use of measuring instruments based on foreign standards or rigging scales. Aristotle (*Mech.*, I, 849b, 34–39) mentions the technique of the purple merchants for rigging their scales, by not placing the string in the center of the scale and by hanging lead or wood on one of the two arms. We also know the law of Erythrai which forbids selling wool on rainy days, as wet wool weighs more heavily on the scales. Aristophanes (*Ran.*, 1386–1388) previously alludes to this fraudulent practice of wool sellers.

Rizzi's recent work (2017; 2014; 2013a; 2013b) on the regulations and sanctions relating to metrological fraud open up new research perspectives in this field.

Conclusion

The imposition of standardized and official metrological standards was a way for public authorities to ensure the proper functioning of commercial transactions. According to Rizzi (Rizzi 2013b, 169–72. See also Morley 2007, 64), the interventions of public authorities were not really part of an 'economic policy' aimed at promoting and increasing trade, but rather aimed at ensuring the accuracy, legality and fairness of economic activities and maintaining social peace. Nevertheless, providing official weights and measures, on the one hand, and the control of magistrates, on the other hand, certainly also made trade more efficient. It could lower the costs of measurement operations, increase the quantity of goods sold and finally reduce the possibilities of fraud.

Abbreviations

ID = Dürrbach, Félix. 1926. *Inscriptions de Délos II* (Paris : Champion)

I.Erythrai = Engelmann, Helmut, and Reinhold Merkelbach. 1972. *Die Inschriften von Erythrai und Klazomenai I* (Bonn: Habelt)

IG I³ = Lewis, David *et al.* 1981. *Inscriptiones Graecae, I: Inscriptiones Atticae Euclidis anno anteriores* (Berlin: de Gruyter)

IG II² = Kirchner, Johannes. 1916. *Inscriptiones Graecae, II-III Inscriptiones Atticae Euclidis anno posteriores* (Berlin: de Gruyter)

IG V, 1 = Kolbe, Walther. 1967. *Inscriptiones Graecae, V, Fasc. 1: Laconiae et Messeniae* (Berlin : de Gruyter)

IG XI, 2 = Dürrbach, Félix. 1961. *Inscriptiones Graecae, XI, Fasc 2: Inscriptiones Deli liberae. Tabulae archontum. Tabulae hieropoeorum annorum 314-250* (Berlin: de Gruyter)

IG XII, 5 = Hiller von Gaertringen, Friedrich. 1903. *Inscriptiones Graecae, XII, Fasc 5: Inscriptiones Cycladum* (Berlin: de Gruyter)

SEG XXII = Woodhead, Arthur Geoffrey. 1967. *Supplementum Epigraphicum Graecum XXII* (Amsterdam: Brill)

SEG XXIV = Woodhead, Arthur Geoffrey. 1969. *Supplementum Epigraphicum Graecum XXIV* (Amsterdam: Brill)

SEG XXVI = Pleket, Henry Willy, and Ronald Sidney Stroud. 1979. *Supplementum Epigraphicum Graecum XXVI* (Leiden: Brill)

SEG XLVII = Chaniotis, Angelos, Henry Willy Pleket, Ronald Sidney Stroud and Johan Strubbe. 2000. *Supplementum Epigraphicum Graecum XLVII* (Amsterdam: Brill)

SEG XLVIII = Chaniotis, Angelos, Henry Willy Pleket, Ronald Sidney Stroud and Johan Strubbe. 2001. *Supplementum Epigraphicum Graecum XLVIII* (Amsterdam: Brill)

SIG³ = Dittenberger, Wilhelm. 1920. *Sylloge inscriptionum graecarum III* (Leipzig: Hirzelium)

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