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A Problem of Cotton and Lead in Medieval Italian Shipping

By John E. Dotson

In transportation, as in other fields of economic activity, merchants and seamen of the Middle Ages often took the first steps toward recognizing and solving fundamental business problems. If their solutions sometimes only laid the groundwork for future developments, they were nonetheless often elegant in their simplicity and suitability to the conditions of the time. One such fundamental problem encountered in shipping in any age is rooted in the varied nature of merchandise.

If all goods had the same ratio of weight to volume (setting aside for now the question of the interaction between shipping costs and the relative value of the goods to be shipped), the ship operator's task would be greatly simplified: rates would need only to be set at so much per ton. Merchandise varies in density, however, so that the same weight of different commodities occupies varying amounts of space. A ton of cotton and a ton of lead aren't the same size. If *ad quantitatem* rates are established with some relatively heavy item in mind, such as grain, then difficulties may arise when a merchant presents to the ship operator some light goods, such as cotton. It is immediately evident that the carrier will lose money if he accepts the light goods at the same rate per ton of weight as the heavier wares, since fewer tons of it will fill his ship. The logical thing to do, and what is usually done, is to accept the lighter cargo on the condition that it pay freight on the basis of the volume which it occupies rather than according to its weight. For the opposite reason one would not want to ship exceptionally heavy goods according to their volume. Thus, some system is needed which will take account of the widely varying weights and volumes of possible cargoes which the ship operator may encounter.

In modern practice freight charges are usually based on the "freight ton" or "shipping ton," which can be either a unit of weight or of volume, depending upon which will produce the most revenue for the ship. To determine which is the most desirable, operators consider the "stowage factor" of the goods to be shipped. The stowage factor is defined as "the number of cubic feet actually occupied by one long ton of a commodity, including an allowance for broken stowage."¹ Naturally it is to the carrier's

¹ J. Bes, *Chartering and Shipping Terms*, 5th ed. (Hilversum, 1960), p. 185. On p. 161, broken stowage is defined as "the cargo space which is unavoidably lost when stowing general cargo": i.e., it is the empty spaces left between the items or containers when they are stowed in the ship's hold. The amount of broken stowage may vary considerably with a variety of conditions, and many lists of stowage factors do not make allowance for it. Lists of stowage

advantage to base the freight charges for those items with a stowage factor greater than the standard upon their volumes, and those with a stowage factor less than that of the standard upon their weight.

This problem was recognized in the Middle Ages, and the approach to a solution had already begun before the first years of the thirteenth century. In a variety of places, lists were drawn up which established ratios for figuring freight charges on various items of merchandise. Usually the lists indicated that for the purpose of calculating freight charges a certain quantity of one commodity was to be regarded as the equivalent of so much of another. These ratios were not, strictly speaking, stowage factors as just defined, but they served the same purpose. There are two differences: first, the medieval lists, as will be seen, established simple ratios among a few categories, each of which contained a variety of goods; second, they did not require a calculation of volumes. All adjustments were made according to weight, which could be easily obtained from the ship's steelyard, or by simple count of the number of items in the shipment. This system did not have the almost infinite flexibility of the modern one, but it did have the advantage of simplicity. In order to distinguish these ratios from stowage factors properly so-called, I will refer to them here as "freighting equivalents."

Apparently the earliest discussion of a system of freighting equivalents is found in Leonardo Fibonacci's treatise on practical arithmetic, the *Liber abbaci*, written in 1202. In one passage Fibonacci goes far to make clear the principles used in formulating the lists of freighting equivalents. After discussing methods for converting one system of weights into another he comments that this kind of calculation is "very useful in loading ships when they are loaded with diverse goods, the size and weight of which vary," a good statement of the problem considered here. He then gives his description of the operation of the system of freighting equivalents:

Ships which are loaded in Djerba are loaded by the cantar of hides. Since they are loaded with different goods which are heavier or lighter than hides, and have more or less volume, it was long ago ordained that of alum, which they put in the bottom of the ship, they put two cantars for one of hides; of goat-skins, which are lighter than hides, they put two cantars for three; of rabbit skins or sugar they put one cantar for two of hides. Similarly, ships which load in Sicily are loaded by the *collus*, which contains 100 *rotuli*, and they put three cantars of copper in one *collus*. Ships which are loaded in Alexandria are loaded by the *sporta* of pepper, which is also 100 *rotuli*, and they reduce various other goods to this *sporta* according to regulations which it is not necessary to mention since anyone can ask when he finds it necessary.²

Fibonacci had spent a good deal of time in Africa, whence he is supposed to

factors for a wide range of commodities are published in manuals intended for the use of ship operators.

² Baldassare Boncompagni, ed., *Scritti di Leonardo Pisano*, 1: *Il liber abbaci* (Rome, 1857), p. 117, my translation.

have brought the knowledge of “Arabic” numerals to Europe, and it is evident that in this passage he is describing an important facet of mercantile practice.

One should note that goods were loaded according to the principal export of the place of origin of the cargo. The merchant was allowed to put into the ship a lesser weight of a commodity which was lighter than the standard and more of one which was heavier. The ship’s steelyard could be used to determine accurately the quantities to be shipped, thus forestalling possible arguments over calculations of volume, or whether supposedly standard packages were over- or undersized, and so forth.

The passage, informative as it is, is still tantalizing. The practices of the very important Egyptian port of Alexandria are mentioned, but not discussed. Unfortunately, it is no longer possible to get information concerning the medieval regulations in that city in the way Fibonacci suggested: by simply asking around the port. But other sources have survived which do enable us to discover much about shipping practices there in the thirteenth century. The most important of these is the *Racione de Alexandria*, a Venetian merchant miscellany composed late in that century.³ This source confirms Fibonacci’s statement that the *sporta* of pepper was the standard for shipping from Alexandria. Further, it fleshes out this assertion with information about how other goods were related to this basic measure. A thorough examination of the *Racione* would require too great a digression from our subject. For the purposes of this article a glance at two important commodities is sufficient to illustrate how the system worked. Pepper, the standard, was calculated at five cantars market weight per *sporta*. Two and one-half cantars of cotton made the equivalent of this *sporta*. This ratio of two to one between pepper and cotton was a widespread, standard freightage equivalent. In short, the *Racione* indicates that practice at Alexandria accorded with what we shall soon see was general practice in the Mediterranean.

The freightage lists and similar equivalents recorded in law codes, merchants’ manuals and miscellanies, and contracts of affreightment indicate that there was a system of freightage equivalents that was in some sense general to Italian shipping in the late Middle Ages and probably to other shipping as well. It is possible to interpret the regulations concerning freightage equivalents that appear in law codes as safety regulations like much other medieval maritime law, such as the statutes governing loading and stowage that have such a prominent place in the Venetian statutes. That they are related to the establishment of freight rates, rather than only to the stowage or loading of ships, is indicated by the rubrics of several lists and by their use in freight contracts. For example, Pegolotti begins the list of freightage equivalents in his famous merchants’ manual, “How goods are counted for freight charges . . .,”⁴ while a fourteenth-century Venetian commonplace

³ Venice, Biblioteca Nazionale Marciana, MS Ital. cl. XI, cod. 87 (6226).

⁴ “Come le mercatantie si contano a nolo. . .” Francesco Balducci Pegolotti, *La pratica della mercatura*, ed. Alan Evans (1936; repr. New York, 1970), p. 157.

book, the *Zibaldone da Canal*, heads a similar list, "Written below are how goods ought to be put in a ship according to whether the patron has freighted by the bale or by the thousandweight."⁵

In Venetian maritime law certain of the freighting equivalents were established by statute in the codes redacted under the doges Jacopo Tiepolo in 1233 and Ranier Zeno in 1255.⁶ The lists found in these statutes were applied to cargoes loaded on ships in Oltremare, that is, in the areas once conquered by the crusaders, but they accord well with equivalents from many other sources. Since these statutes provide the most fully elaborated system of freighting equivalents that has survived, it is worthwhile to examine them in some detail.

Tiepolo's statute assumes that all goods were to be shipped by the cantar, an eastern weight.⁷ In the early thirteenth century goods were generally freighted according to the measures of the port where they were loaded, as indicated in the passage from Fibonacci just quoted. This practice seems to have continued in the trade of lesser ports, such as Ancona and Aigues-Mortes, well into the fourteenth century, long after Venice had achieved enough importance to impose her own system of measures in many markets.

The standard in Tiepolo's list is the class of things which were to be counted as *merces de imbolio*, that is, as "light goods" or "packaged goods."⁸ A cantar (the cantar of Syria, equal to 750 *libbre sottili* of Venice, or 495 pounds English)⁹ of these goods was to count as one unit, to pay a cantar's freight. The six items counted as light goods were: cotton (which heads the list), cotton thread, "grays" (a kind of cloth), licorice, sugar in boxes, and lavender. There follows another, longer list of goods which I call "cargo goods" from the phrase in the rubric, "Et hee sunt merces que pro carico computari debent." Among the thirty-two items in this list were pepper, ginger, cloves, and silk. The shipper was allowed to load two cantars of these heavier commodities while paying the same amount that was charged for one cantar of light goods.¹⁰ A third class of merchandise contained seven items, among

⁵ "Queste si e le merchadantie scrite qua de soto como elle se de' metere in nave secondo como lo paron avesse nollicado a balla o altre merchadantie che se nollicasse a millier." Alfredo Stussi, ed., *Zibaldone da Canal* (Venice, 1967), p. 39.

⁶ Riccardo Predelli and Adolfo Sacerdoti, eds., *Gli statuti marittimi veneziani fino al 1255* (Venice, 1903).

⁷ The question of medieval metrology is a complicated one. The cantar, for example, is a common unit, but its exact weight varies from place to place. In order to help the reader (and myself) form a clearer idea of the weights and measures involved in this paper I have endeavored to give approximate English equivalents. These have, for the most part, been derived from Evans, *La pratica*, who in turn used Angelo Martini, *Manuale de metrologia* (Turin, 1883).

⁸ Predelli and Sacerdoti, *Gli statuti*, p. 73 f. "Package goods" is a more literal translation since "imbolium" is related to the modern Italian "invoglio," a package, bundle, or wrapping. "Light goods" is perhaps more descriptive of their nature, at least to modern ears. At Genoa similar items were known as "merces de volumine." Cf. also Walter Ashburner, *The Rhodian Sea Law* (Oxford, 1909), p. clvii and note.

⁹ The Venetian *libbra sottile* was equal to 0.66 pounds English according to Frederic C. Lane, *Venetian Ships and Shipbuilders of the Renaissance* (Baltimore, 1934), p. 245.

¹⁰ Predelli and Sacerdoti, *Gli statuti*, p. 73.

them flax and cinnamon, that were to be counted at the ratio of three cantars for two of the light goods. These second and third classes consisted mostly of spices and fine cloths. Lead was considered separately. It could be counted as a part of the ballast if the patron declared his intention to do so before the ballast was loaded. If he decided to do so later, an amount of ballast equal to the weight of the lead that was loaded on the ship could be removed. This part of the regulation, involved as it was with the ballasting of the ship, seems more concerned with safety than with regulation of freights, but as we shall see later this may be only partly true.

The situation reflected in Zeno's code is more complex. The same three classes of packaged goods, cargo goods, and ballast were retained, but with considerable elaboration. In the twenty-two years that passed between 1233 and 1255 Venetian weights had been given more importance in the freighting of the republic's ships in overseas ports. Cargo goods, the largest class, at least in number of commodities, were to be loaded by the *milliarium*, a measure of 1,000 Venetian pounds, while light goods continued to be loaded by the Syrian cantar. This would seem to be a step toward the complete dominance of Venetian measures in Venetian shipping.

The two major classifications, packaged goods and cargo goods, were thus separated by the use of different weights into two parallel systems of freighting equivalents in Zeno's statutes. Tiepolo's list gave all equivalents in terms of packaged goods. In Zeno's lists there were separate schedules in operation, one for packaged goods, which paid by the cantar, and one for cargo goods, which paid by the Venetian *milliarium*. Freighting equivalent classifications were then established within each group. In fact, this division does not seem to reflect any change in the system of freighting equivalents, but was determined only by the fact that two different standards of weight were used.

While a single statute had sufficed to define the system in Tiepolo's code, there is a separate statute for each type of merchandise in Zeno's.¹¹ Two statutes deal with the class of goods that could be loaded as ballast. The first lists those which "ought to be loaded as ballast," all of them heavy metals.¹² The second lists merchandise that might be counted as ballast if it seemed desirable to the ballasting committee to replace part, or all, of the ballast with these goods. Included in this second class of ballast goods were unworked glass, emery, orpiment, vitriol, rock alum, and white alum from Alexandria. The items from this group that are similar to items found in modern lists have stowage factors ranging from 37 to 89, while the metals that had to be counted as ballast are grouped closely around 10.¹³

¹¹ Predelli and Sacerdoti, *Gli statuti*, pp. 160–62.

¹² The list comprised lead, iron, tin, and unworked bronze.

¹³ Modern stowage factors referred to in this article are from the list in Joseph Leeming, *Modern Ship Stowage* (New York, 1968), pp. 430–690. Other works on this topic that I have found useful are Thomas R. Taylor, *Stowage of Ship Cargoes* (Washington, D.C., 1920) and William L. Grossman, *Ocean Freight Rates* (Cambridge, Md., 1956).

The list of items that might optionally be stowed as ballast appears to have been taken directly from Tiepolo's list of goods that were to be shipped two cantars for one of packaged goods. These items stand out from the rest of the goods with which they were grouped in the earlier statute by being, on the average, substantially heavier than the others, whose modern stowage factors range from 80 to 135. A warning is probably in order here to the effect that modern stowage factors can, at best, be taken as only a very rough basis for comparison, since methods of packing can greatly affect the calculation of these figures and very little is known about medieval packing.

By allowing these goods to be counted among the ballast, rather than the cargo, it would seem that a logical step had been taken in changing the status of certain items which appear anomalous in the earlier list. A lower rate on heavier goods that could take the place of ballast, which produced no revenue at all, would seem to be in the interest of shipper and carrier alike. Because of the close regulation of the way in which ships were loaded and ballasted, specific provisions had to be made in the statutes before any other goods could be substituted for ballast. Thus we find in the codes specific goods that might be counted as ballast.

The second, and largest, class of goods in Zeno's code is that of merchandise that was to be shipped "as cargo."¹⁴ Included in this list of forty or so items were the spices from the list of cargo goods in Tiepolo's statute, two cantars of which were to be shipped for one of packaged goods. These were the goods that were to be freighted by the *milliarium*. In this series the heavier items formed the standard and the shipper was allowed to load fewer *milliaria* of less dense goods in proportion to the standard. Two more statutes complete the series for cargo goods. These list several types of cloth and skins that were to be shipped four for five and three for four of the standard. One could, for example, ship four *milliaria* of pepper, grain, or some other item included in the same list for the same cost as three of linsey-woolsey or raw sheepskins. On the other hand, one could load three *milliaria* of pepper for the same cost as two *milliaria* of woolen cloth.¹⁵

In the third class were packaged goods, still shipped by the cantar. In this series the commodities with the least weight in relation to their volume were taken for the standard. The series begins with "merchandise that is put in the cargo three cantars for two of packaged goods." This list, which contained, among other things, flax and cinnamon, was followed by the list of standard packaged goods, such as cotton and washed wool.¹⁶

These Venetian statutes present us with what is probably the most comprehensive and structured exposition of the system of freighting equivalents, but long lists are also found in several merchants' manuals, especially Francesco Pegolotti's and the *Zibaldone da Canal*. The merchants' manuals expand the lists of commodities, making possible a more detailed knowledge

¹⁴ Predelli and Sacerdoti, *Gli statuti*, pp. 160 f.

¹⁵ Predelli and Sacerdoti, *Gli statuti*, p. 161.

¹⁶ Predelli and Sacerdoti, *Gli statuti*, p. 162.

of the system, but they have little to add regarding the fundamental principles. The manuals do reveal that a large number of goods were shipped by count, rather than by weight. For example, in both Pegolotti's manual and the *Zibaldone* we find that 25 galley oars were to be counted as the equivalent of one *milliarium*. Pegolotti gave other equivalents based on count: for example, 1,000 lamb fells or 400 staves for small barrels for one *milliarium*.¹⁷

Having examined the principles of the system of freighting equivalents as found in the maritime codes of Venice and in merchants' manuals, we may consider briefly how this system operated in practice.

An example will indicate how the statutory freighting equivalents operated to modify what would otherwise appear to be a flat *ad quantitatem* rate. In the thirteenth century the Venetian government owned and operated fleets of large nefs (roundships).¹⁸ The oath that was sworn by the *patroni* of these communal ships traveling in the *mudua* to Acre in 1282 has survived. In this oath the *patronus* swears to perform faithfully all his duties and functions, which are spelled out in great detail. Among the information to be found in this oath is the rate to be charged for freight from Acre to Venice: six *byzants saracenat* per cantar of Acre.¹⁹ This appears on the surface to be a flat rate on all goods without regard to their bulk or density. However, when goods were actually presented for shipment this flat rate was modified by application of the proper freighting equivalents as provided by the statutes discussed above. This meant that when, as in this case, the standard rate was six *byzants saracenat* per cantar, pepper would pay that rate, alum would pay three *byzants saracenat*, cotton twelve, and so on. There was no need to specify these details in the oath of the *patronus* or in any individual contracts; the statutory provisions would have been a matter of general knowledge.

The situation in the western Mediterranean was more complex and less systematized, but still recognizably embodied the same principles. The Genoese established no statutory lists of freighting equivalents as did the Venetians and other Adriatic peoples. A possible explanation for this may be found in the different legal traditions of the two areas. The Adriatic ports of Italy had continued to participate in the older and more definitely established maritime legal tradition of the eastern Mediterranean, such as that represented in the early Middle Ages by the Rhodian Sea Law.²⁰ This eastern tradition did not place much emphasis on the necessity for a written contract, so the freight contract, or charter-party, at Venice does not seem to have assumed the importance that it had at Genoa. Another factor to be taken into account is that the government of the Venetian republic always

¹⁷ Stussi, *Zibaldone*, p. 41, and Evans, *La pratica*, p. 157.

¹⁸ Frederic C. Lane, "Merchant Galleys, 1300–34: Private and Communal Operation," *Speculum* 38 (1963), 184.

¹⁹ Archivio di Stato di Venezia, Miscellanei atti diplomatici e privati, busta 7, pergamena no. 235.

²⁰ Guido Bonolis, *Il diritto marittimo dell' Adriatico* (Pisa, 1921), pp. 634 ff.

took a close interest in the operation of the Venetian merchant marine and in the late Middle Ages entered actively into the operation of merchant vessels. All these conditions would tend to encourage the establishment of certain ground rules for shipping in statutes that would serve to define the conditions for loading and the payment of freight in the absence of a written contract. On the other hand, at Genoa, and in the western Mediterranean generally, commerce was less centrally organized, and the older commercial traditions were not drawn upon as readily. These conditions encouraged the development of a written contract for each voyage, and this in turn made the development of statutory ground rules seem less necessary.

However, the same basic condition of commerce prevailed; it was still easier and more accurate to weigh goods than to try to figure volumes. Some method of making allowance for variations in the density of commodities was still required, and a system of freighting equivalents was the obvious solution. And, since the goods were more or less the same, approximately the same equivalents were used. This is especially evident in freighting contracts that provided for goods to be delivered to the ship in another port. In these contracts, the goods to be shipped were usually unspecified. Often, in fact, they were unknown even to the merchant himself, except in very broad terms, until he arrived at his destination and the conditions of the market became apparent. In a case like this certain generalized agreements had to be made beforehand and included in the contract in order to prevent disputes when it came time to load the ship. The situation is the same as that just described for the Venetian *mudua* to Acre. Rules were laid down in the home port for the shipment of goods to be acquired later overseas. In the Venetian case they were made known through statute and the public oath of the *patronus* of the *mudua*. At Genoa (and elsewhere in the western Mediterranean) they were agreed upon between individuals according to customary principles and embodied in a contract recorded by a notary.

In the contracts, the most general classification of merchandise distinguished heavy goods and light goods. Heavy goods are called *merces de savurra* or *de sarcina*, literally, ballast or burden goods, and are the same as the cargo goods of the Venetian codes. Light goods are called *merces de volumine* and are the same as the Venetian *inbolio*. These very general classifications do not seem to have come into use before the end of the thirteenth century and were probably a result of changes in the general business situation, which saw the increased use of agents and representatives to conduct operations in distant ports.

Occasionally the ratios were actually expressed as freighting equivalents. One of the most common of these was to allow three *torselli* or large bales of linen to be carried at the same rate as two of woolen cloth. This equivalence is not directly comparable with the Venetian lists of freight equivalents, but in Zeno's code woolen cloth is shipped as packaged goods while linen cloth is found among the cargo goods. Other commonly encountered equivalents were: alum, two for one of general cargo; cotton, one for two; and so forth.

Two phrases often appear in Genoese freight contracts to indicate how freight charges were to be figured. These were, allowing for the usual variations in language, “prout descendit de staheria” (“just as it comes from the steelyard”) and “facta ad navem” (loosely, “adjusted to the ship”). The first indicated that charges were to be figured on actual weight as obtained from the ship’s weighing device; the second indicates charges according to weight adjusted by the usual freighting equivalents. These phrases do not occur in every contract, but when they do appear there can be no doubt as to what is meant.²¹

In July 1253, three large ships, the *Regina*, the *Sanctus Gabrielus*, and the *Paradisus*,²² prepared to leave Genoa for Oltremare. There are many interesting details in the contracts for this voyage that are outside the scope of this paper, but here they may be taken as examples of the latitude for bargaining that might be found in the shipping of mid-thirteenth-century Genoa. These three are especially good for this comparison since they were contracting at the same time for the same destination. In fact, these ships may have planned to sail in convoy, since all the contracts require the merchants to have their cargoes loaded in time for a mid-August sailing date.

The freighting provisions vary considerably among the three ships. The merchants who booked space on the *Regina* agreed to guarantee a loan by a third party to the ship’s operator for the fitting out of the vessel. Certain freights on the outbound leg of the voyage were to be paid by the Genoese cantar, “prout descendit de staheria.” However, specified goods were excluded from this arrangement. The excluded goods either were extremely dense (tin, bronze, and lead) or occupied a considerable amount of space in relation to weight (hempen thread, wooden plates and bowls). On the return voyage freight was to be paid according to the cantar of Acre and “facta ad navem.”²³ The merchants who went with the *Paradisus* entered into a more

²¹ Cf. Eugene H. Byrne, *Genoese Shipping in the Twelfth and Thirteenth Centuries* (Cambridge, Mass., 1930), p. 48, n. 1. Byrne’s interpretation is essentially correct, though he seems to imply at one point that the figures that I have referred to as “freighting equivalents” are proportions of the total cargo being shipped.

²² This *Paradisus* was not the famous *Paradisus Magnus*, but a smaller ship operated by the same company and referred to elsewhere as the *Paradisus Minor* (cf. Byrne, *Genoese Shipping*). The name of the larger ship has been explained as referring to the large accommodations which it provided for merchants (Robert S. Lopez and Irving W. Raymond, *Medieval Trade in the Mediterranean World* [New York, 1955], p. 240). A more likely explanation would seem to be that since the same company operated two ships both called *Paradisus*, they were distinguished by referring to the one as the “big *Paradise*” and the other as the “little *Paradise*.” The *Paradisus Minor* was, however, small only in comparison with its sister ship. The size of the crew is one of the most easily obtainable figures from which one can gain some idea of the relative size of medieval ships. The *Paradisus Magnus* normally carried a crew of 100 men, the *Paradisus Minor* a crew of 70. The two other ships mentioned in the text, *Regina* and *Sanctus Gabrielus*, carried 90 and 70 men respectively. These ships were among the largest afloat in the mid-thirteenth century.

²³ Archivio di Stato di Genova, sezione Notai, Cartolare 29 (attributed to Bartolomeo de

typical contract, one that arranged for cargo space both outbound and return on the “facta ad navem” basis.²⁴ Arrangements for the *Sanctus Gabrielus* were still different. Merchants this time arranged for space only on the outbound voyage. Charges were to be based on weight (“prout descendit de staheria”) but with the specific condition that bales of linen cloth were to pay freight for three cantars for every two of actual weight, a common freighting equivalent encountered in the contracts, as was mentioned above.²⁵ It was fairly common for the contract to specify a rate for “merces” or “rei” or some such general indication and then to specify certain equivalents for other goods when the phrase “facta ad navem” did not appear, as in this case. It can be seen from the provisions of these contracts, and the impression is confirmed by numerous others, that there are many aspects of the voyage that were open to negotiation, but the basic framework of freighting equivalents was accepted as stable.

Sometimes no system appears to be operating at all, and a different rate is quoted for each commodity to be shipped. Nothing is said of freighting equivalents, nor are there references to payment “facta ad navem.” This is natural when shipper and carrier can meet face to face and bargain over rates to be paid on goods that are known and ready to be presented for shipment. This is, of course, the most flexible approach, allowing consideration to be taken of minor variations in density, conditions of the transportation market, and, probably, even the bargaining skills of the parties to the contract. But on closer examination the underlying system of freighting equivalents emerges, obviously implied in the rates quoted in the contract. For example, a Genoese contract of 1201 for a small nef to go between Genoa and Bougie in Algeria gives a rate of two *soldi* Genoese per cantar of flax and three *soldi* Genoese per cantar of cotton.²⁶ This is easily recognizable as the same ratio of three of flax for two of cotton that is found in the Venetian codes and in Pegolotti’s manual.

It has been said that the freight rate structure of the medieval Mediterranean shipping industry was primitive, that it merely levied flat *ad quantitatem* rates, applying the same rate for equal quantities no matter what the merchandise to be shipped. This argument was presented in the greatest detail by the late Federigo Melis. He advanced a thesis, based on extensive research

Fornari), fol. 148r–v. The two acts relating to this voyage, both dated July 7, 1253, were published as one by Byrne, *Genoese Shipping*, doc. XXX.

²⁴ Archivio di Stato di Genova, sezione Notai, Cartolare 29, fol. 158r–v. Published in Byrne, *Genoese Shipping*, doc. XXXIII.

²⁵ Archivio di Stato di Genova, sezione Notai, Cartolare 29, fol. 160v. Published in Byrne, *Genoese Shipping*, doc. XXXIV.

²⁶ Archivio di Stato di Genova, sezione Notai, Cartolare 6 (attributed to Guglielmo Cassinese), fol. 170v, published in Margaret W. Hall-Cole, Hilmar C. Krueger, R. G. Reinert, and Robert L. Reynolds, *Giovanni di Guiberto (1200–1211)*, 1 (Genoa, 1939), doc. 348, and also in Byrne, *Genoese Shipping*, doc. II. For the Venetian codes see Predelli and Sacerdoti, *Gli statuti*, pp. 73 and 161 f. In Evans, *La pratica*, p. 158, the ratio is given as 1½ cantars of flax for 1 of cotton.

in the Datini archives, which, briefly stated, asserted that before the last decades of the thirteenth century *ad quantitatem* rates hindered development of commerce because, in effect, they discriminated in favor of expensive luxury goods: that is, expensive goods paid less for transportation in relation to their worth than did cheaper goods. As a result, he argued, only luxuries, which could bear the costs, and necessities, which had to be moved at any cost, were transported.²⁷ Full consideration of Melis's argument would require the discussion of freight rates, an extensive and complicated topic, but the presence of a system of freighting equivalents strongly suggests that the rate structure of the Italian shipping industry at least as early as the thirteenth century (and probably earlier) was more complex than it appears on the surface. The system of freighting equivalents provided for a measure of discrimination in the rate structure. This is even more evident when we consider that those heavy goods that could be shipped for a third or a fourth of the cost of shipping the lighter ones were also generally less expensive and less able to bear freight costs. A reasonably complete picture of the rate structure would need to include not only freighting equivalents, but many other factors as well. For example, the overall rate structure was affected by the division of labor between galleys, which ordinarily carried expensive goods and charged high freights, and round ships, which carried cheaper goods for lower freights. This division became much more important toward the end of the thirteenth and the beginning of the fourteenth centuries. Furthermore, certain goods of great value in small compass, such as cash, jewels, and certain rare dyes, often paid *ad valorem* rates.

The system of freighting equivalents offered, then, a number of advantages to both shipper and operator. Using simple ratios and relatively few classes of merchandise, it allowed for variations in goods in a way that could be easily computed, either by weighing the items using the ship's steelyard or by counting the items to be loaded. It was a system admirably suited to provide the flexibility needed by a developing shipping industry in the age of the traveling merchant, when shipping arrangements often were made before the nature of the cargo was known.

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²⁷ Federigo Melis, "Werner Sombart e i problemi della navigazione nel medio evo" in G. Barbieri, et al., *L'opera di Werner Sombart nel centenario della nascita* (Milan, 1964), pp. 119 ff. I have here rather crudely summarized only one of Prof. Melis's points from this valuable article, but to do more would carry us too far afield from the topic at hand.