XXI.—Land and Sea Transportation in Imperial Italy

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The importance of transportation as a determining factor of the economic history of any period cannot be denied, but despite the singular extent of our knowledge of ancient industry and agriculture, we know practically nothing about the equally important problem of transportation beyond the fact that it was costly and difficult. The need, therefore, for an investigation of the problem arises not only from its own general importance but also from its relation to the wider problem of the production and distribution of food in Italy.

To determine the actual costs of transportation in Italy is not an easy task. Some scholars[1] refer to the inscriptions discovered throughout Italy during the past forty years and reported in the *Notizie degli Scavi*[2] as an indication of the cost of land transport.[3] These do not, when examined carefully, shed any light on this problem, since they deal only with the costs of road paving and bridge building, but not with the cost of transporting road building materials over definitely known distances.

Some information, however, is conveyed by a passage of Cato's (*RR* 23.3) concerning the price and cost of transporting an olive crusher: "A mill," he says, "is bought near Suessa (25 miles from the estate) for 400 HS and 50 lbs. of oil. The cost of assembling is 60 HS and the charge for transportation by oxen, with 6 day wages of 6 men, drivers included, is 72 HS. The bar complete costs 72 HS and there is a charge of 25 HS for oil; the total cost is 629 HS. At Pompeii (75 miles from the farm) a mill is bought for 384 HS, freight 280 HS." From this passage we learn that the transportation of a heavy article by ox-team was 17% of the cost for a distance of 25 miles, but when moved 75 miles the cost came to nearly 75% of the

[1] Rostovtzeff, *Storia economica e sociale dell'impero romano* (Florence, 1933) 166 ff.; 185 f., 423, 440–441; Hirschfeld, *Kaiserl. Verwaltungsbeamten*[2] (Berlin, 1905) 203 note 1, 209 note 3.

[2] *Not. d. Scavi*, 1915, 26; 1918, 140; 1921, 69; 1929, 220; all referred to by Rostovtzeff, *Storia economica*, 167 note 9.

[3] *Not. d. Scavi*, 1918, 140: L. Octavius Onesimus, viam Mactorinam, longa vetustate resciss(am) pecunia sua restituit, (a)cceptis ab r(e)p(ublica), in(ve)ctui silicis hs. XIIII m(ilia) n(ummum). . . .

original purchase price. In other words the price of a heavy commodity was more than doubled after it was hauled a distance of 100 miles. Fortunately, in a later passage of his treatise on agriculture, Cato gives us sufficient data about the dimensions of olive crushers to determine their weight. According to my calculations, based on the dimensions given by Cato and on the archeological material collected by Drachmann and Hoerle, the largest sized crusher must have weighed about 3,000 lbs.[4] The mere cost of transportation, therefore, not including the hiring of an ox-team, would be at the rate of 2 or $2\frac{1}{2}$ HS per ton-mile or, in our money, 12 or 13 cents per ton-mile.[4a] The rate based on the data from Cato seems low when we consider the cost of transporting similar articles in Hellenistic and Roman Greece,[5] where the cost of hauling tiles a distance of 12 miles added at least 40% to the original cost, or a shipment of stone purchased for 61 drachmae in Corinth was sold for 705 drachmae in Delphi. Perhaps the comparatively low cost of transporting Cato's

[4] According to Hoerle, *Catos Hausbücher* (Paderborn, 1929) 193, the weight of the *trapetum* was 4,000 lbs. The main parts of the crusher were the *mortarium* (bowl-shaped immovable part), the *miliarum* (solid column standing inside the *mortarium* and rising slightly above the rim), and the *orbes* (millstones). For a description of the *trapetum* see Hoerle, *op. cit.* 193; A. G. Drachmann, *Ancient Oil Mills and Presses* (Copenhagen, 1932) 8 ff.; *JRS* 52 (1932) 116 ff.; 56 (1936) 72 ff.; Hoerle in *RE* s. v. "Trapetum"; Blümner, *Technologie* I.333 ff.; 346; A. Hug in *RE* s. v. "Μύλη." The *mortarium*, *miliarum* and *orbes* were the only parts that would be transported, since the *cupa* was made and assembled by the farm mechanics. The weight of the *orbes* was about 450 kg. (cf. Drachmann, *loc. cit.*), that of the *mortarium* and *miliarum* neither Drachmann nor Hoerle calculated. But the table of dimensions compiled by Drachmann and Hoerle, based on figures supplied by Cato, *RR* 135.6 and on measurements taken from the *trapetum* found near Pompeii (cf. Pasqui, "La Villa Pomp. della Pisanella presa Boscoreale," *Monumenti Antichi* 7 [1897] 397–554), indicates a weight of 3,000 lbs. The weight of 4,000 lbs. mentioned by Hoerle, *op. cit.* 193, I find to be mathematically incorrect.

[4a] In converting Roman prices into American dollars and cents, I have followed the practice of Frank in the first volume of his *An Economic Survey of Ancient Rome*[2] (Baltimore, 1933), hereafter referred to as *ESAR*. These are Gold Standard or pre-Roosevelt dollars and are intended only for the convenient comparison of ancient costs and prices. Their purpose here is to enable the reader to determine what percentage of a given price is due to cost of transportation.

[5] Authority for this statement is *CAH* 5.20, which unfortunately fails to give the ancient source. According to Glotz, *Ancient Greece at Work* (Eng. trans. by M. R. Dobie, London, 1926) 295 note 1, the cost of shipping 100 tiles by sea from Corinth to Eleusis was only 20 obols, about half of the cost quoted by Tod in *CAH*. That the cost of land transport in Greece was almost prohibitive is clear from the fact that the transportation of stone from Corinth to Delphi brought the original price of 61 drs. up to 705 drs. See Michell, *Economics of Ancient Greece* (Cambridge, 1940) 252; Glotz, *Histoire de la Grèce* (Paris, 1925) 292 note 1; Jardé, *Les céréales dans l'antiquité grecque* (Paris, 1925) 196.

oil-crusher may be explained by the fact that the oxen and wagons were not included in the costs, being equipment belonging to the estate. Furthermore the entire cost of hauling was made up of the wages paid to the slaves, which, of course, were extremely low.

The costs of transportation in Cato's time seem extremely high when we compare them with the price level of 150 B.C.[6] Olive oil then was worth less than 7 cents a quart, beef 5 cents a lb., wine 3 or 4 cents a quart, a sheep $1.20 cents; the wages of a slave were 10 cents a day, of a free man 15 cents a day. In Cicero's time a laboring man still received about 20 cents a day and 15 cents were paid to a soldier in Caesar's army. Little change in wages and prices occurred during the entire history of the Roman Empire.[7] Diocletian fixed the maximum wages of unskilled workers at 10.8 cents per day, of skilled workers such as bricklayers, carpenters, and blacksmiths at 21.6 cents, and of painters at 32.4 cents. The tariff price of beef and mutton was $4\frac{1}{2}$ cents per lb., pork and lamb 7 cents per lb., eggs 5 cents a dozen, turnips 1 cent a dozen; and fowl were sold for 12 cents each.[8] In 64 A.D. the price of wheat was held at 3 HS per modius or about 60 cents a bushel (Tac. *Ann.* 15.39), the same price as it had been in the time of Cato, 150 B.C.[9] Wheat was perhaps the only article of food which came close to the abnormally low prices of 1932.[10] The high price of Italian wheat was a result of constant scarcity in Italy because of the persistent demand for the armies and the low yield per acre. All the other things which supplied the physical needs of the working classes could be obtained at one-tenth or one-fifteenth of modern prices. The fantastic prices which the rich then paid for some luxury foods,

[6] On prices during the time of Cato, cf. Frank, *ESAR* 1.187, 284.

[7] Frank, *ESAR* 1.187, 384 ff.; 5.234 ff.

[8] *Edict of Diocletian*: wages 7.1–15; meats 4.1–50.

[9] On wheat prices in Italy, see Frank, *ESAR* 1.158, 191 ff., 205, 402; Rostovtzeff in *RE* s. v. "Frumentum" 148–9; A. Oliva, *La politica granaria di Roma antica* (Piacenza, 1930) 95, 168. Oliva thinks that the average price of wheat from Cato to Nero was about 3 HS per modius or 60 cents a bushel. N. Jasny, "Wheat Prices and Milling Costs in Classical Rome," *Wheat Studies* (Food Research Institute, Stanford University, vol. 20, 1944) has argued that the prices of the various grades of flour quoted by Pliny (*NH* 18.10.90) indicate that the price of wheat was much higher than is usually believed. But see below, note 46.

[10] The price of wheat in 1932 ranged from 55 to 75 cents a bushel, according to N. Jasny, *Competition Among Grains* (Food Research Institute, 1940). The average weekly price of spring wheat in Chicago from 1894/5 to 1903/4 was 73–77 cents a bushel; from 1904/5 to 1913/4, 92–97 cents a bushel; from 1922/3 to 1929/30, $1.33–$1.40 a bushel, according to H. S. Irwin, *Seasonal Tendencies in Wheat Futures Prices* (U. S. Dept. of Agriculture. Grain Administration, 1936) 4 ff.

spices, and works of art did not affect the cost of living of the average man.[11] In the Pompeii of 79 A.D. the cheaper taverns advertised a litre of wine for 1, 2, or 4 asses — 2 to 7 cents (*CIL* 4.1679), and in the second century wine was still sold in Italy for 4 cents a litre (Dessau, 7212–7213). A Pompeian business man could rent a residence of moderate size for conversion into a fullery for about $7.00 a month (*CIL* 4.1, p. 392).

Supposing that in Cato's time the same rates were charged for the transportation of wheat as for olive crushers, we find that the cost of transporting it 100 miles by ox-team would come to about $12.50 per ton. As the price of wheat on the Roman market was then $20.00 per ton, the freight was equivalent to about 62% of the Roman price and an Italian farmer growing wheat 100 miles from Rome would receive only $7.50 per ton. Yet transportation charges in Cato's time were considerably lower than those established by Diocletian's *Edict* (17.3),[12] which set the freight rate on a wagon with maximum loading capacity of 1200 Roman pounds at 20 denarii per Roman mile, equivalent to $21.00 per ton per hundred miles.[13] Since the ceiling price on wheat was 100 denarii per castrensis modius or 85 cents a bushel, a farmer living 100 miles from Rome would sell his wheat for $7.30 per ton or 24 cents a bushel. It is not to be wondered at that the large scale production of wheat was unprofitable and that Italy was unable to support herself in cereals.

But the ox-drawn wagon was not the regular method for transporting grain. We learn from Varro (*RR* 2.6.5) that grain was regularly transported by means of pack animals and that some large estates specialized in the breeding of asses and mules for this pur-

[11] The fantastic sums paid for large and small works of art and for articles of luxury are listed in Frank, *ESAR* 1.352 ff.

[12] The costs of land transport during the third and fourth centuries A.D. remained high in spite of the extensive repair and construction of roads and bridges carried out by Trajan and Hadrian, see Frank, *ESAR* 5.72, 96, 278; O. Hirschfeld, "Die röm. Meilensteine" in his *Kleine Schr.* 703–743; id. *Kaiserl. Verwaltungsbeamten*[2] 205–211. Trajan's repair and construction of roads and bridges is fully discussed by R. Paribeni, *Optimus Princeps* (Messina, 1926) 121 ff.; Ashby and Gardiner, "The Via Traiana," *PBSR* 8.104–171; cf. Galen 10.632–633 quoted by Frank *ESAR* 5.278. Hadrian also repaired several roads in Italy, among them a 15 mile stretch of the Appian Way at a cost of 100,000 HS per mile (*CIL* 9.6075).

[13] 1 R. mile = 5,000 ft.; 1,200 R. lbs. = 860 Eng. lbs. Transport of 1 ton of wheat would cost 49 denarii per mile, or 4900 per 100 miles. As the Diocletian denarius was worth about 0.43 cents (cf. note 49), the cost of transporting a ton of wheat would come to $21.07.

pose. Asses and mules were used for grain transport in Egypt[14] and according to Cicero (*Verr.* 2.3.183) also in Sicily.[15] Since a pack ass was able to carry a load of 250 lbs., at least 8 of them would be required for the transportation of a ton of wheat. According to the *Edict* the cost of transportation by this means was from $1\frac{1}{3}$ to $1\frac{3}{4}$ denarii per mile per castrensis modius or about $15.00 per ton per hundred miles. This does not, however, include the wages of a driver who was paid 15 cents a day. As the average speed of transportation was not greater than 8 miles per day,[16] the time required for 100 miles would be about $12\frac{1}{2}$ days or 25 days for the round trip. We must therefore add $7.50 for wages, and the total cost of transportation would amount to $22.50 per ton per hundred miles, that is assuming one driver was capable of managing a convoy of 8 mules.[17] The cost of wheat was, therefore, doubled after being transported 100 miles, no matter what method of transportation was employed to move it over that relatively short distance. Miss Graser in her paper on the recently discovered fragments of Diocletian's *Edict* has pointed out that the rates fixed for land transport could have applied only to very short distances and that there was very little transport of low cost bulky commodities.[18]

That the cost of transportation for even shorter distances must have been prohibitive has been shown by Rostovtzeff, who calls our attention to the prevalence of famines even in such rich grain-producing regions as the Po Valley, Central Italy, and Northern Africa.[19] Quite a number of inscriptions from those regions refer to the frequency of famines not only during the first century but also in the time of Marcus Aurelius.

[14] M. Rostovtzeff, *Social and Economic History of the Hellenistic World* (Oxford, 1941) 1.314, 315; 3.1391; "Angariae," *Klio* 6 (1906) 249 ff.; "Kornerhebung und – Transport im griech. – röm. Aegypten," *APF* 3 (1906) 201 ff.; *A Large Estate in Egypt* (Madison, 1922) 122; O. Seeck in *RE* s. v. "Angarium"; H. Zilliacus, *Aegyptus* 19 (1939) 59 ff.; U. Wilcken, *APF* 13 (1939) 223; F. Hartmann, *L'agriculture dans l'ancienne Égypte* (Paris, 1923) 131 ff. See especially Johnson, "Roman Egypt," *ESAR* 2.403 f.

[15] On transport in Sicily, cf. Frank, *ESAR* 3, "Roman Sicily" (Scramuzza) 292.

[16] The speed of land transport will be discussed below, note 36.

[17] On costs of transportation in Italy, see Frank, *ESAR* 5.279.

[18] Cf. E. R. Graser, "Two New Fragments of the Edict of Diocletian," *TAPhA* 71 (1940) 161.

[19] Rostovtzeff, *Storia economica* 169 ff., quotes many examples of famine in the Greek East, Italy, and Africa, resulting from the difficulties and high cost of inland transport.

The high cost of land transport seems to have had a revolutionary effect upon Italian agriculture, since it diverted farmers from producing wheat for sale and encouraged instead the production of those grains suitable for feeding livestock. Since it was easier to drive cattle and hogs to market over the roads of Italy than to transport grain, it was only natural for the Italian farmer to substitute the breeding of livestock for the raising of wheat. We read in Pliny (*NH* 10.53) the almost incredible statement that in 50 A.D. flocks of geese were driven on foot to Rome all the way from Holland and the lowlands of the Rhine. Polybius (2.15.1) tells us that most of the hogs marketed throughout Italy in 150 B.C., both for private consumption and for the army, had been driven from the farms of Cisalpine Gaul. At that time the farmers of Northern Italy were not only able to feed their hogs on the acorns which fell from the oak forests dispersed over the plain but to fatten them on grain which was produced in great abundance and, owing to inadequate means of transportation, was worth only a seventh of what grain was bringing in Rome.[20] It is a reasonable guess that the abnormally high production of barley and oats in Northern Italy was used for the feeding of livestock. It was no accident that in Cisalpine Gaul and Apulia, both great producers of grain, cattle breeding was extensively carried on.[21] Then, just as nowadays, farmers would often find it more profitable to feed their grain to livestock than to transport it long distances over poor roads to Rome, where it would meet

[20] Nissen, *Italische Landeskunde* (Berlin, 1883–1902) 2.55; G. E. F. Chilver, *Cisalpine Gaul, Social and Economic History from 49 B.C.* (Oxford, 1941) 129. Polybius (12.4.8) speaks of the large swine herds in Cisalpine Gaul and in the western part of Etruria. Strabo (5.1.12), describing the prosperity of the Po Valley, says that the forests there produce acorns in such quantities that Rome is fed mainly on the herds of swine that feed on them. Frank (*ESAR* 5.167) says that the Romans were very fond of pork and that "Apicius (book 7) has 32 recipes for the preparation of this meat."

[21] Cattle breeding in Cisalpine Gaul was very extensively carried on, if one may judge from the statements of Vergil, *G.* 3.176; Columella, *RR* 7.24.5; Pliny, *NH* 8.1.19; cf. A. Oliva, *op. cit.* (see note 9) 242; also in Apulia, Varro, *RR* 2 praef. 6. The Umbrian and Sabine regions were noted for cattle breeding (Verg. *G.* 2.146; Columella, *RR* 3.8.3). Pliny (*NH* 11.241) and Martial (1.43.7) spoke of Umbrian cheese. Pliny gave favorable mention to Sabine cheese (*NH* 11.241; 13.31.33). Campania seems to have raised swine during the entire Imperial period. The export of Campanian pork was mentioned by Petronius 75–76, and various passages in the *Codex Theod.* speak of consignments of Campanian and Samnian pork to Rome. See Cardinali, "Frumentatio" in De Ruggiero's *Dizionario Epigraphico* 3.297. Skeletons of swine were found at Boscoreale: Day, "Agriculture in the Life of Pompeii," *YCIS* 3 (1932) 174. The breeding of cattle in the Sarno Valley, near Gragnano, and the making of cheese is discussed below, note 23. On cattle breeding in Gaul, see also Varro, *RR* 2.5.9–10.

competition with grains transported by sea.[22] That was the reason why the farmers of Latium did not object when grain was first brought into Rome from Sicily, seemingly in competition with their own grain, since the standard of living was rising as a result of the conquests and an increasing demand for meat made cattle breeding profitable.[23] Hence, grazing and cattle breeding must have begun to flourish even before large scale importations of foreign grain had begun. Nor did animal husbandry cease to be profitable after the Latian and Campanian farmer had turned to the production of oil and wine. Oxen had always been needed on the farm for draft purposes; but as there was a steadily rising demand in the large cities for milk, cheese, beef, and poultry, the breeding of live stock became a valuable adjunct to wine and olive farming. Furthermore, viticulture cannot be carried on long without supplying the land with heavy and frequent applications of manure, and in the absence of guano and chemical fertilizers, the necessary complement of viticulture was the stabling and stall-feeding of farm animals.[24] Varro (*RR* 2 praef. 4) and Columella (6 praef. 2: copiosa stercora-

[22] Polybius 2.15; 34.8.7–10. See Frank, *ESAR* 1.195 ff.; Nissen, *op. cit.* (see note 20) 2.56; Gummerus, *Römische Gutsbetrieb* (*Klio*, Beiheft 5 [1906] 23); Mommsen, *Röm. Gesch.* 1⁸.841. Hatzfeld, *Les trafiquants italiens* (Paris, 1919) 218 note 5, questions the idea that the difficulties of land transportation prevented the movement of grain from the Po Valley to other parts of Italy. Hogs, he says, were shipped from that region to every part of Italy despite the problem of transportation. Why not grain? The answer is that hogs were driven on foot, while grain could only be transported by mule-back or ox-team. The ease, says Nissen (*op. cit.* 2.55), with which cattle could be driven from place to place before roads were made explains why cattle in primitive times became a convenient medium of exchange.

[23] The demand for beef and other meats increased greatly during the last century of the Republic and the first century A.D., according to Frank (*ESAR* 5.163); *Economic History of Rome* (Baltimore, 1927) 415; O. Seeck, *Geschichte des Untergangs* (Berlin, 1897) 1.371, 380; Nissen 2.92. The demand for meat is indicated by Domitian's early edict (69 A.D.) forbidding the slaughter of animals for religious sacrifices, a measure intended to conserve livestock after the destruction of the civil war. See Suet. *Dom.* 9.1; Frank, *ESAR* 5.55; K. Scott, *AJPh* 55 (1934) 225 f. On the sale of cheese, milk, lambs, wool, and hogs, see Cato, *RR* 2.7, 150. Cheese was also prepared for export: hoc genus casei potest etiam trans maria permitti (Col. *RR* 7.8.6), cf. Gummerus, *op. cit.* (see note 22) 79. A large cheese factory was found near Gragnano outside of Pompeii and the skeletons of cows were found in the stable, cf. *Not d. Scavi*, 1923, 275 ff.; Day, *op. cit.* (see note 21) 174; Carrington, *JRS* 21 (1931) 125. In *CIL* 4.4422 and 5380 the sale of cheese is mentioned and *CIL* 4.5184 mentions the sale of 6 heifers. See note 21.

[24] This thesis was suggested in part by a brief paragraph in O. Seeck's book *Die Geschichte des Untergangs der antiken Welt* (Berlin, 1897) 1.371. I find evidence for it in Cato, Varro, Columella, and Palladius. The *RE* articles "Landschaft," "Geflügelzucht," "Schaf," and "Stier" do not help much, nor the dissertation of F. Vincke, *Die Rinderzucht im alten Italien* (Giessen, 1931). However, Frank, *Econ. Hist.* 100,

tione, quae contingit e gregibus; also 2.1.7; 2.2.13–14) both urged farmers to keep as many cattle as their land could feed. To feed these in winter the farmer had to go to the hay-rack and the granary, and it became more and more the practice to grow cereals, especially barley, for the stock as well as for the slaves.[25] The finer grades of wheat were probably not grown on this kind of farm. Columella recommended barley for all livestock, and especially for fattening poultry, when mixed with wheat (*RR* 2.9.14–16). He had no use for *siligo*, that delicate white wheat, much favored in Rome, for it was a degenerate variety, not worth growing by a practical farmer (*RR* 2.6.3, 2.9.13).[26] The excavation and study of the *villae rusticae*

103, cf. *ESAR* 5.159 and M. Weber, *Römische Agrargeschichte* (Stuttgart, 1891) 221, have pointed out that even before the time of Cato the keeping of cattle was imperative for owners of wine and oil estates because of the need for manure. The need for manure was so great that Cato and the other scriptores r. r. insist on the construction of pits in order to conserve all liquid as well as solid manure. Cato recommended both winter and summer stall feeding of cattle as the best source of manure for vines and olives; he raised grain on his estates for feeding purposes (*RR* 4 and 13; Weber, *op. cit.* 221). Pliny (*NH* 17.50), Columella (2.15.1), and Palladius (10.3.2) advised heavy manuring (21 loads of 80 modii each per jugerum). Poultry manure was considered especially desirable for vines (Col. 11.2.86–87). Cf. also Col. 3.11.4, 11.2.86.

The breeding of cattle was beneficial for the land in that it stimulated the growing of legumes such as lupins, vetch and clover which not only make excellent fodder but restore nitrogen to exhausted soils. The subject of nitrogenous crops is treated by Columella (*RR* 2.13.1). Turnips are also beneficial to the land and excellent for feeding purposes and were extensively grown on Cato's estates (cf. E. Brehaut, *Cato the Censor*, p. xxvii). See the discussion of Roman and Medieval agriculture by Clapham and Power, *Cambridge Economic History* (Cambridge, 1941) 1.1180 ff.

[25] Heitland, *Agricola* (Cambridge, 1921) 267. In Varro's opinion (*RR* 2 praef. 5) it was often more profitable for the farmer to feed livestock than to sell the grain. He recommended the feeding of barley to swine (2.1.17, 4.6), to sheep (2.2.13), cattle (2.5.17), milk-cows (2.10.2), and poultry (3.5.3): Pascuntur omne genus obiecto frumento, maxime hordeo. Itaque Seius eis dat in menses singulos hordei singulos modios. Of course, other grains such as wheat, spelt, millet were fed to poultry (3.5.4–5, 7.8, 9.13, 10.5–6). Palladius (1.25) recommended wheat and millet for fattening doves, half a modius a day for a flock of 130. Experiments conducted at the Oklahoma Experimental Station show that wheat is nowadays considered the best of all grains for fattening fowls and livestock and superior as a milk producer. Cf. "Wheat Feeding" in *Oklahoma Experiment Station*, Bulletin 13, Dec. 1894. But for Palladius as well as for Varro and Columella, barley was the more favored grain in feeding all kinds of animals and poultry (*RR* 1.24–30; 5.7; 12.13).

[26] In *RR* 2.9.13, Columella calls *siligo* a kind of *tritici vitium* (cf. 2.6.1 f.). Pliny (*NH* 18.91) had about the same opinion of *siligo* as Columella. On the varieties of wheat, cf. A. Schulz, "Die Geschichte des Weizens," *Zeitschr. f. Naturwissenschaft* 83 (1912) 46 ff.; N. Jasny, "What Prices and Milling Costs in Classical Rome," *Wheat Studies* 20 (1944) 148 ff. See also Jasny's remarks on *siligo* in "Wheats of Classical Antiquity," *Johns Hopkins Studies in Historical and Political Science* 62 (1944) no. 5, 62 ff., where he defends its breadmaking qualities, but admits that it is a poor producer.

have already shown that while specialization in the production of oil and wine was the rule, a good deal of diversification or mixed farming was evidently practiced. A good example is the farm near Gragnano where stables for horses and cows were found as well as threshing-floors and equipment for making cheese, a farm which, as Rostovtzeff has said, was self-supporting as far as possible and formed a little world for itself.[27] Whether the villa-owners near the larger cities who, in Varro's day, specialized in the breeding of chickens, geese, ducks, pigeons, thrushes, peacocks, pheasants, and other fancy fowls, raised on their estates the large amounts of grain they fed or preferred to buy local or imported grains, it is not easy to determine. At any rate, most Latian and Campanian farmers, we learn from all ancient writers of agriculture from Varro to Palladius, combined the production of oil and wine with grain growing and the keeping of livestock.[28] They did not, therefore, fear the competition of imported grains; they were able to turn adverse competition into a profit for themselves. One cannot read Varro's treatise on agriculture without being impressed by the enormous fortunes made by those who supplied the demands of the luxury trade in Rome.

The competition of the more cheaply produced and the more easily transported grains of Egypt and Africa was evidently bringing about in Sicily a transformation of agriculture similar to what we have seen happening in Italy.[29] Since the days of Cicero, Sicily had gradually been becoming less important as a grain-exporting country, although Rostovtzeff has shown that Sicilian grain was still to some extent transported to Rome as late as the second century A.D.[30] Yet Sicily, although for five successive centuries the supplier of

[27] Rostovtzeff, *Storia econ.*, description of Plate X, chapter XI.

[28] Varro, *RR* 3.2–11; Columella, *RR* 8.12–15; Palladius, 1.24–30; 5.7, 12.13; Pliny, 10.156 ff.; Horace, *Sat.* 2.8.88; Suet. *Vitell.* 13.2.

[29] On Sicilian agriculture, see the following studies: J. Carcopino, "La Sicile agricole au dernier siècle de la république romaine," *Vierteljahresschr. f. soz. u. Wirtschaftsgesch.* 4 (1906) 128 ff.; Rostovtzeff, *Studien zur Gesch. d. röm. Kolonates* (Berlin, 1910) 229 ff.; E. S. Jenson, *History of the Province of Sicily* (Boston, 1919); R. Scalais, "La prospérité de la Sicile," *Musée Belge* 28 (1924) 86 ff.

[30] Rostovtzeff in *RE* s.v. "Frumentum" 129–132; *CIL* 6.29, 809; Matz-Duhn, *Ant. Bildwerke*, III no. 3095; Appian (*Bell. civ.* 5.72) speaks of Sicily: πέμποντα Ῥωμαίοις τὸν ἐκ πολλοῦ τεταγμένον αὐταῖς φέρειν σῖτον. Strabo (6.273) tells of the importance of Sicily for Rome's grain-supply. Frank (*ESAR* 5.293; 3.350) thinks that Sicily sent to Rome 9,000,000 modii annually, nearly half of the Egyptian export. Trade-marks on amphorae show that Sicily also sent to Italy a considerable quantity of wine. Cf. Frank, *Economic History* 257. Pliny, *NH* 14.66, mentions Sicilian wine as fourth best. It was produced mostly in two localities, Messana and Tauromenium. Tauromenian wine was exported to Pompeii (*CIL* 4.2618, 5563–5568).

Athens, Carthage, and Rome, could no longer meet the competition of Egyptian and African grains. In fact, especially in the valleys, she turned her attention to viticulture, gardening, and the breeding of livestock. Once more she produced meat and cheese for which she had once been famous and which in the fifth century B.C. had been exported to Athens.[31] So extensive had this transformation in agriculture[32] become that some of the cities along the eastern and southern coasts became, instead of exporters, importers of grain by sea.[33]

Transport, then, playing as it did a decisive role in the transformation of Italian and Sicilian agriculture, deserves further examination. We have seen that land transport was costly, but it was also slow as compared with sea or river transport. Therefore, access to the sea or a river was regarded by all writers on ancient agriculture as a prime necessity of a good estate.[34] The construction of good roads was of great military and political importance for the Empire and of great economic importance for inland cities and towns, yet at no time, even after the great road-building programs of Trajan and Hadrian had been completed, was it possible to move goods as quickly and as cheaply by highway as by sea or river. According to Cato it took an ox-team 6 days to go to Suessa, 25 miles from the estate, and bring back an olive-crusher. The ordinary speed of land transport would therefore be about 8 miles per day.[35] Ovid tells us (*Ex Ponto* 4.5.8) that 9 or 10 days were required to cover the distance from Brundisium to Rome, which according to Goetz indicates a rate of 6 miles per day. The speed of

[31] The evidence for the export of cheese from Sicily to Greece during the 4th and 5th centuries B.C. comes from the fragments of the Comic poets: Philemo, fg. 76 (Kock 2.499) and Antiphanes, fg. 236 (Kock 2.115). Cf. H. Knorringa, *Emporos* (Amsterdam, 1927) 99.

[32] Rostovtzeff, *Storia econ.* 243. Extensive cattle breeding in Sicily seen in Horace, *Epist.* 1.12. Scramuzza in his account of Roman Sicily (Frank, *ESAR* 3) speaks of stock-raising as an integral part of the economics of wheat production (351). "Wheat-growing and cattle-breeding went hand in hand; not merely for supplying the farm with draft animals but to get additional revenue from the sale of beef, hides, wool, and cheese. The grower of wheat was a cattle breeder and a sheep raiser as well" (278). In Augustus' time Sicily exported to Italy cattle, hides, wool, etc. (Strabo 6.2.7); the size of the herds of cattle and sheep on Grosphus' Sicilian estate is referred to in Horace, *Carm.* 2.16.33–37.

[33] Cf. Rostovtzeff, *Storia economica* 75.

[34] Cato, *RR* 1.3: oppidum validum prope siet aut mare aut amnis qua naves ambulant, aut via bona celebrisque; also Gellius 10.26.8; Varro 1.16; Columella, *RR* 1.2.3; 3.3.3–4; cf. Gummerus, *Gutsbetrieb* 22 ff., 59, 80.

[35] W. Goetz, *Die Verkehrswege im Dienste des Welthandels* (Stuttgart, 1888) 339 ff.

transport from Rome to Capua over mountainous roads was not greater than 4 miles per day. We would, therefore, be justified in assuming that in ancient Italy the average speed of land transport was between 6 or 7 miles per day.[36] Not until the eighteenth and nineteenth centuries was the problem of land transport overcome. In the ancient world it was always slow and painful.

On the sea, however, transport was relatively fast even in ancient times. It was not until the building of the Yankee Clipper and the modern yacht that sailing ships of the modern era, even with an improved type of steering-gear, surpassed the speed of ancient ships.[37] In the Roman Imperial period travel and communication by sea had become more regular and in many cases easier and safer than by land. When Herod Agrippa wanted to go to Syria by way of Brundisium, the emperor advised him to make the trip on an Alexandrian grain ship whose pilot was experienced and was sure to get him to his destination. The ship, on which the Apostle Paul journeyed to Rome, sailed in one day from Rhegium to Puteoli before a strong breeze.[38] Ordinarily, two days were required to sail this distance when there was a very light wind (lenissimo flatu). It is not possible to make a precise estimate of the usual sailing time between Puteoli and Alexandria, for it was affected not only by the season of the year but also by the weather. Thus, we hear of ships taking as many as 27 days and as few as 9. De Saussure has recently compiled a list of voyages mentioned by ancient writers, a few of which might well be repeated here.[39]

[36] R. Van der Borght, "Das Verkehrswesen" in *Hand- und Lehrbuch der Staatswissenschaften* abt. 1, Bd. 7 (1912). Friedlaender (*Sittengeschichte Roms* 1^{10}) has a long discussion on the speed of travel, of messengers, and of the imperial post, but nothing whatsoever on the problem of commercial transport.

[37] On the size, speed, and equipment of the ships built for Rome in Sicilian yards, see Frank, *ESAR* 1.105–108; Scramuzza, "Roman Sicily," *ESAR* 3.287 f. On the steering-gear see R. Lefebvre des Noettes, *De la marine antique à la marine moderne: La révolution du gouvernail* (1935); also F. Miltner in *RE* Supplementband 5 (1931) s.v. "Seewesen" 922; P. Nordmann, *RPh* 64 (1938) 330–2; L. Laurand, *ibid.* 63 (1937) 131–2; H. de Saussure, *Revue Archéol.*, Ser. 6, 10 (1937) 90–105. Ancient ships compare very favorably with those of the later Middle Ages (13th–16th centuries) in size, speed, and methods of propulsion. The medieval merchant had the same fear of shipwreck as had the Roman and an even greater dread of piracy. See J. W. Thompson, *An Economic and Social History of the Middle Ages* (1928) 576–584.

[38] *Acts of the Apostles* 28.

[39] H. de Saussure, *op. cit.* 90 ff.; cf. W. Kroll in *RE* s.v. "Schiffahrt" 410–411; A. Koester, *Das Antike Seewesen* (Berlin, 1923) 180; H. Nissen, *Ital. Landeskunde* 1.132; M. P. Charlesworth, *Trade-Routes and Commerce of the Roman Empire* (1924) 43–44; E. H. Warmington, *Commerce between the Roman Empire and India* (Cambridge, 1928) 5, 48, 49–52; Friedlaender, *Sittengeschichte Roms* 1^{10}.427.

TABLE I

Voyage	No. days	Miles daily	Knots (hourly)	Source and comment
Ostia — Africa	1½	203	8.5	Pliny 19.4.
Puteoli — Alexandria	8½	117	5	Pliny 19.3. Summer voyage; very gentle wind.
Utica — Alexandria	7	146	6	Sulp. Sev. *Dial.* 1.3.1.
Cadiz — Ostia	6½	149	6	Pliny 19.3. Very rapid.
Messina — Alexandria	5½	147	6	Pliny 19.3. Very rapid.
Corinth-Puteoli	4	140	6	Philostr. *Vit. Apoll.* 7.10. Very favorable wind.
Carthage — Cadiz	7	120	5	Ps.-Scylax 69.
Utica — Rome	2½	122	5	Pliny 15.74. Cato the elder displays figs picked at Carthage *tertium ante diem.*
Rhodes — Alexandria	3½	94	4	Diod. Siculus 3.33. Voyage made in April.
Crete — Egypt	4	75	3	Strabo 10.475. Strabo says this voyage can be made in 1 day less.
Cyrene — West Crete	2	75	3	Strabo 10.475. Normal voyage.
Lampsacus — Sparta	3	130	5.5	Xen. *Hellen.* 2.1.30. Herodotus 4.86 reckons 5½ knots as the av. speed of a sailing ship.

From her table of speeds (96–97), De Saussure concludes that the average speed of ancient sailing ships was about 3 or 4 knots, which was at least as great as the average for sailing ships till the middle of the eighteenth century.[40]

Of greater importance than the speed of merchant vessels was the cheapness of transport by sea for trade and commerce in general and particularly for people dependent on food shipped from ports across the Mediterranean. But data on the costs of shipping grain from surplus to deficit countries are difficult to find. That freight rates on the sea were always much lower than on land is clear from the fact that in 329 B.C. the cost of transporting 100 tiles over 12 miles of land from Laciadae to Eleusis was 40 drachmae or 40% of their purchase price, while it cost only 6⅔ drachmae to ship them

[40] Even today the normal speed of tramp steamers used in the grain-trade is between 8 and 11 knots; with the average about 9.5. Liners on the North Atlantic route bring up the average for the speed of grain transportation to about 10½ knots. V. D. Wickizer, "Shipping and Freight Rates in the Overseas Grain Trade," *Wheat Studies* 15.2, 92.

by sea from Corinth, three times as far.[41] But maritime freight rates varied widely throughout the 4th century B.C. In the following century they were stabilized at a higher rate; the transportation of marble by water from Paros to Naxos, 20 miles apart, added 25% to the cost.[42] But marble is difficult to handle and transport so that the freight rate on it was probably much greater than that on grain. Heichelheim, however, has shown that in the period from 270 to 250 B.C. the freight rate alone on the short distance of under 500 miles from Alexandria to Delos was 85% of the price of wheat in middle Egypt; if three other items be included, viz. freight rate on the Nile, loading and unloading, and insurance against shipwreck and piracy, the total cost of transportation was more than double the price of the article at the point of origin.[43] By making the freight rates on the sea vary directly with the distance, he concluded that in 210 B.C. the cost of transporting wheat from Egypt to Rome was 7 attic drachmae per medimnus = $4\frac{2}{3}$ HS per modius (about 95¢ a bushel). Now the year 210 B.C., we are told by Polybius (9.44), was one of great scarcity in Rome, when all Italy had been laid waste by Hannibal's army, and all supplies from abroad were shut off by the war. When the Romans tried to obtain wheat from Sicily, their petition was rejected. The scarcity of wheat in Rome was so great that it went for $2.50 a bushel, three or four times the price prevailing normally from the time of Cato to the reign of Nero.[44] The rates which Heichelheim quoted are, therefore, abnormal. Freight rates in time of war are always abnormal because the risks are greater. The impact of the last war on ocean shipping was so great that the index of ocean freight rates on 78 different routes to the United Kingdom jumped from 95.6 in August 1939 to 472.5 in March 1940. During the same period, marine insurance advanced $12\frac{1}{2}$% on general cargo shipments, and in addition British underwriters made a surcharge of 25 cents on the dollar.[45] If

[41] *Cambridge Ancient History* 5.20; but see above, note 5.

[42] Glotz, "Le prix des denrées à Délos," *Journal des Savants* 11 (1913) 18.

[43] F. Heichelheim, *Wirtschaftliche Schwankungen der Zeit von Alexander bis Augustus* (Jena, 1930) 73, 92 ff. Larsen (in Frank, *ESAR* 4.408) suggests that the high price of wheat at Delos was due to monopolistic practices, not to high freight rates.

[44] Frank, *ESAR* 1.97, 191; R. Scalais in *Musée Belge* 31 (1927) 186 ff.

[45] On shipping rates in World War II, see Hobart S. Perry, *Impact of the Present War on Ocean Shipping* (U. S. Dept. of Agriculture, 1940) 33, 49. Grain berth rates from North Atlantic ports to continental Europe changed from 12 cents to 90 cents per cental seven months after the war began (30). From Australia to the United Kingdom, rates advanced from 30s. to 140s. In table 16, he shows that the index of

Heichelheim's figures on freight rates to Rome were applicable to all periods of Roman history, one would expect to find wheat prices at all times as high as those of 210 B.C. quoted by Polybius. But that was not the case, since the price of wheat in Rome was normally about 3 and probably never higher than 5 HS per modius.[46] One would also expect to find the differential between the Egyptian and Roman price of wheat much greater than it actually was. The fact that the average price of wheat in middle Egypt ranged from 2 to $3\frac{1}{2}$ HS per modius, while the Roman price was from 3 to 5 HS per modius, indicates a fairly low rate of transportation between Alexandria and Rome.[47] But what the rates normally were on grain shipments from Sicily to Rome, it is impossible even to guess except, perhaps, for a short time during and after the Second Punic War. We learn from Livy (30.38.5) that in 202 B.C. supplies coming from Sicily and Sardinia reduced grain prices to such an extent that the grain merchants allowed the carriers to keep the grain to cover shipping costs (pro vectura). How great these costs were may be surmised from other statements of Livy that in the previous year (203 B.C.) the aediles released to the public grain supplies collected in Spain, Africa, and Sicily for 1 HS per modius (30.26.5) and a year or so later disposed of them finally for half that price (31.50). From these statements one may infer that the rates between Rome and Sicily might have been from $\frac{1}{2}$ to 1 HS per modius even in time of war. If so, they are low in comparison with the freight charges of $1\frac{1}{2}$ HS per modius, which Heichelheim (*Wirtschaftliche Schwankungen* 92) assumes as normal between Athens and Delos, a distance not greater than 100 miles.

The problem involving freight rates on grain transported by sea has been largely cleared up by the recent discovery at Aphrodisias in Caria of two fragments of Diocletian's *Edict* containing freight rates.[48] These fragments give the rates for general cargoes, un-

grain shipping rates changed from 98.55 to 672.46 from American ports of the Northern Range to the United Kingdom.

[46] Jasny, "Wheat Prices and Milling Costs in Classical Rome," *Wheat Studies* 20 (1944) 144 f., argues convincingly that Heichelheim (*Wirtschaftliche Schwankungen* 73, 93) was also at fault in applying the rates for vegetable oil to grain. It is, therefore, improbable that Heichelheim's rates apply even in 210 B.C.

[47] On grain prices in Egypt, Sicily, and Rome, see Appendix.

[48] The new fragments of the *Edict* were published by Giulio Jacopi, "Gli scavi della missione archeologica Italiana ad Afrodisiade nel 1937," *Monumenti Antichi* 38 (1939) 130–152; cf. E. R. Graser, "Two New Fragments of the Edict of Diocletian," *TAPhA* 71 (1940) 161 ff.; they are also discussed by N. Jasny, "Wheat Prices and Milling Costs

fortunately not also for fiscal cargoes, in denarii per castrensis modius for 37 Mediterranean trade lanes. Since the ceiling price on the sale of wheat set by the *Edict* (1.1) was 100 denarii per castrensis modius (about 85 cents a bushel), the rates are really percentages of the selling price, nor must the fact be overlooked that these are maximum rates. In the following table are listed the rates in denarii and in cents per bushel:[49]

TABLE II

	Source	Destination	Rates Denarii per castrensis modius	Cents per bushel
Aphr. 1.24	Alexandria	Rome	16	13.8
Aphr. 1.29	Alexandria	Africa	10	8.6
Aphr. 1.30	Alexandria	Sicily	10	8.6
Aphr. 1.28	Alexandria	Aquileia	24	20.6
Aphr. 1.50	Africa	Sicily	6	5.2
Aphr. 1.51	Africa	Spain	8	6.9
Aphr. 1.53	Africa	Greece	12	10.3
Aphr. 1.52	Africa	Gaul	4	3.4
Aphr. 1.61	Nicomedia	Rome	18	15.5

A comparison of the rates quoted in the fragments with modern rates for ocean grain carrying leaves little doubt that the ancient rates were considerably higher. The average freight on wheat from New York to Liverpool during the period 1922–1938 was 5.8 cents per bushel, although the distance is well over 3,000 sea miles.[50]

in Classical Rome," *Wheat Studies* 20 no. 4, reviewed by T. R. S. Broughton in *CW* 38 no. 5 (Oct. 1944).

[49] The rates in cents per bushel were worked out by using the following data: a castrensis modius was twice as large as the common modius = 17.51 liters (Hultsch in *RE* 3.1775; Blümner in *RE* 5.1955). Cf. Jerome, *Comment. in Ezechiel* 1.4: Hin duos choas Atticos facit, quos nos appellare possumus duos sextarios Italicos; ita ut Hin mensura sit Judaici sextarii, nostrique castrensis, cuius sexta pars facit tertiam partem sextarii Italici. The American or Winchester bushel = 2150.42 cu. in. or 35.2383 liters (U. S. Bureau of Standards, 1937); 100 copper denarii of Diocletian (1 Roman pound of fine gold in bars or coins = 50,000 copper denarii) were worth 1.827 marks (Hultsch, *RE* 5.211; Blümner, *RE* 5.1954). Since the mark at the time of Hultsch's writing was worth 23.82 cents in New York, we reach a value of about 43 or 43½ cents for 100 denarii. But if, as Hultsch surmised, the denarius was worth slightly less, then my calculations are slightly high; but they give the same result as that given by F. F. Abbott (*The Common People of Ancient Rome* [New York, 1912] 156, 168).

[50] The data on modern freight rates are obtained from V. D. Wickizer, "Shipping and Freight Rates in the Overseas Grain Trade," *Wheat Studies* 15 (1938) no. 2, Table IV p. 119. Data on wheat prices on the English market are derived from *Wheat Studies* 14 (1937) 181.

Since the average price of No. 1 Manitoba hard on the British market was $\$1.17\frac{1}{2}$ during the years 1922–1938, the shipping rates are actually less than 5% of the price of Canadian wheat at British ports. The freight on wheat from the Russian Black Sea ports to Antwerp and Hamburg, a voyage of more than 3,500 miles, was 7.5¢ per bushel, while from Australia to Liverpool, almost ten times as far as from Egypt to Rome, the shipping charge was only 20.7 cents on the bushel, which is about 17% of the average English market price ($1.17) of Australian wheat during the same period.[51] The cost of shipping Argentinian wheat from La Plata Down river to the United Kingdom was barely 11% of the average British market price. On that basis, it is probable that the rates of the *Edict* were three times the modern ones. Even so, the rates for carrying grain by sea were much lower than commonly believed before the discovery of the Aphrodisian fragments of the *Edict*, and extremely low in comparison with the rates established for land transport. Miss Graser has recently pointed out that the rates quoted for land transport of from $1\frac{1}{3}$ to $1\frac{3}{4}$ denarii per hundred pounds per mile would be too expensive for much long-distance transport. "The unit of a mile in reckoning costs also indicates that these are rates used in short hauls."[52]

In the time of Diocletian two classes of freight rates probably existed side by side, one for private shipping, another for fiscal cargoes intended for Rome. The special rate for fiscal cargoes is unfortunately not known, except that fiscal cargoes to Rome obtain their special rates of 2 denarii per castrensis modius (Aphr. 2.3–4: if grain is meant the rate would be 1.7 cents per bushel), but the port from which the shipment started is not stated. Nor have I been able to verify the correctness of Frank's statement that wheat was carried from Alexandria to Rome at the rate of 2 cents per bushel.[53] But in the first century, with which we are chiefly concerned, there were probably no fiscal rates, as all export and import trade including the grain carrying service was still in the hands of private ship owners, although the state had organized these men into guilds and commandeered vessels for the *annona* earlier than was done in the case of any other economic activity.

[51] In 1935 the average rate of shipping bulk wheat from Australia to the United Kingdom was 20 shillings per ton, *U. S. Foreign and Domestic Commercial Commerce Bureau, Trade Promotion Series*, No. 185 p. 71.

[52] E. R. Graser, *op. cit.* (see note 48) 162.

[53] Frank, *Economic History of Rome* 316.

The freight rates on shipping from Alexandria to Rome were listed in the *Edict* at 16 denarii per castrensis modius, or 13.8 cents per bushel. Low as these may seem as compared with the costs of transport by land, they were probably much higher than the rates on grain coming to Italy during the Republic and the first century A.D., when Puteoli was the port at which most of the larger Alexandrian grain ships docked.[54] It seems logical to suppose that the rates to any Campanian port like Puteoli, Naples, or Pompeii were considerably lower than those established in the *Edict*. Now the rates set by Diocletian for the whole empire were, no doubt, based on the standard costs of shipping from Alexandria to Ostia. Ostia or Portus had first been developed as port of Rome by Claudius, and during the second, third, and fourth centuries of the empire was the sole terminus of the grain traffic between Egypt and Italy. The use of Ostia, as a port, once docking and unloading facilities were provided, was natural, for it had several obvious advantages.[55] In the first place it was near Rome. The ever present threat of famine made it dangerous to use a port like Puteoli separated from the capital by a distance of 138 miles. From Puteoli the supplies had to be carried by land, a slow and expensive process. Ostia was clearly marked out by nature to be the main harbor of Rome. But during the Republic, the harbor had been neglected, and the river was allowed to choke up its channel with silt so that large ships had

[54] In the time of Cicero, Puteoli was the port at which the Alexandrian grain ships docked: Cic. *Fin.* 2.26.84. After the construction of the winter harbor at Ostia, ships from the East still continued to use Puteoli: Pliny, *NH* 19.3 (see Frank, *ESAR* 5.237 note 44); *Acts of the Apostles* 28.13; Seneca, *Ep. Mor.* 77.1–2. Sogliano ("Colonie Neroniane," *Rend. Lincei* 6 [1897] 389 ff.) thinks that the Neronian colonies' being in Puteoli is an indication of the importance of the place in Nero's time; cf. C. Dubois, *Pouzzoles Antique* (Paris, 1907) 70–71. Even after Trajan the port of Puteoli was not entirely abandoned; cf. *CIL* 10.1562 (time of Hadrian): DISP A FRVMINTO PVTEOLIS ET OSTIS and comment: itemque sub imperatoribus naves frumentarias urbi destinatas tam Puteolos appulisse quam Ostia; cf. *CIL* 10.1729, 15.7172. The harbor of Puteoli was improved and provided with new installations by Antoninus Pius (*CIL* 10.1640). This shows that Puteoli was considered an important shipping center even during the 2nd century A.D. Oliva (*op. cit.* 233) says that ships larger than 200 tons continued to use Puteoli even after the time of Trajan; cf. Lehmann-Hartleben, "Die Antike Hafenanlagen," *Klio*, Beiheft 14 (1923) 160 ff.

[55] On the harbor and shipping facilities of Ostia, see especially the useful collection of material in Frank, *ESAR* 5.236 f.; also, F. H. Wilson, "Studies in the Social and Economic History of Ostia," *PBSR* 13 (1935) 41 ff.; J. Carcopino, *Ostie* (Paris, 1929) 8 ff.; also his article "Création et vie du port romain d'Ostie," *Soc. Géogr. de Lille* 77 (1935) 312; Lily Ross Taylor, *The Cults of Ostia* (Bryn Mawr, 1912) ch. 1; G. Calza, "Ostia," *Art and Archeology* 8 (1919) 337; also *Capitolium* 5 (1929) 437; Scramuzza, *Claudius*, 166 ff.

to stand out to sea and discharge their cargoes by lighters at great risk of damage in stormy weather.[56] The senate, not interested in trade and commerce, did nothing. Caesar felt the need of a suitable port for Rome, but had no time to carry out his plan. Finally the project of Caesar, discussed for years by engineers and debated in the rhetorical schools by students, was carried into execution by Claudius and completed by Nero.[57] The Claudian harbor, however, did not yet provide sure shelter for large ships,[58] since the entrance was exposed to north and northwest winds, which blew so violently at times that a fleet of 200 vessels once broke away from their moorings and were battered by the moles meant to protect them.[59] This defect was remedied by Trajan[60] and not till then did Ostia fully displace Puteoli in providing anchorage for ships larger than 200 tons.[61]

But the main disadvantage from which Ostia as a port always

[56] Strabo 5.35.

[57] Quintilian, *Inst. Or.* 2.21.18; 3.8.16. Cf. R. Paribeni, *Optimus Princeps* (Messina, 1927) 2.104 ff.

[58] By the time of Claudius so much silt had been carried down and deposited by the Tiber at its mouth that only very small ships, not larger than 30 tons, could cross the bar. Cf. Rasi, *Sul Porto Romano di Ostia* (Roma, 1826) 31–32; Lehmann-Hartleben, *op. cit.* (see note 54) 181 ff. Claudius saw how necessary was the deepening of the harbor at Ostia for Rome's food supply, when he himself was compelled to board a small boat to take him up the river to Rome; cf. Suet. *Claudius* 38; Seneca, *De brev. vitae* 18.

On the enormous task performed by Claudius of creating a new harbor and port at Ostia, we have both literary and epigraphical sources of information; cf. especially Suetonius, *Claudius* 20: opera magna potiusque necessaria quam multa perfecit . . . portum Ostiae exstruxit. . . . This engineering feat is described also by Cassius Dio 62 and briefly by Pliny *NH* 16.76, 36.14. The celebrated inscription (*CIL* 14.85) found at Portus proclaims that the deepening of the harbor had freed Rome from all danger of floods: fossis ductis a Tiberi operis portus causa, emissisque in mare, urbem inundationis periculo liberavit. The hope of controlling floods, however, was not realized; the city experienced a most disastrous flood in 69, cf. Suet. *Otho* 8; Tac. *Hist.* 1.86.

Coins of Nero's reign also refer to the development of the port but do not mention Claudius; cf. Cohen, *Nero* 33–41, 252–254. They have on them instead the legend PORTVS AVGVSTI or PORTVS AVG. (cf. *CIL* 15.5). Eckhel 6.277 explains this as follows: Claudii honorem sibi vindicavit Nero, qui forte, si quid residui operis erat, perfecit.

[59] Tacitus, *Ann.* 15.18 in 62 A.D.; Ammian. Marcell. 19.10.4.

[60] Oliva, *op. cit.* (see note 9) 233. Trajan's Portus was an inner hexagonally shaped basin connected with the Tiber by a canal. It offered more protection to ships against the winds than the outer basin constructed by Claudius, cf. Lehmann-Hartleben, *op. cit.* 182 ff. Wilson, *op. cit.* (see note 55) 41–68; Paschetto, *Ostia*, 78 ff. The port of Civitavecchia was also restored; cf. Calisse, *Storia di Civitavecchia* (Florence, 1936) and bibliography, 25 note 3.

[61] Frank, *Economic History* 411–412; Oliva, *op. cit.* 233.

suffered and which never had been overcome lay in the fact that ships putting in here had to leave port empty. Rome was a consumer of what the world produced, not a producer; her imports were enormous but her exports negligible, and trade between Rome and the provinces had always been a one-way affair. The well-known axiom of shipping economics was violated here, that return cargoes must be available if carriers are to make a profit, otherwise the freight rates must be higher. No sooner had Claudius succeeded in diverting the grain ships from Puteoli to Ostia than he got into difficulties with the captains and ship owners. They objected to the necessity of taking their ships an extra 150 miles up the coast and exposing them to the hazardous weather conditions around Ostia and of losing the profits of valuable return cargoes provided at the deep water port of Puteoli. As grain-carrying earnings were small as compared with the profits on the luxury trade, Claudius in order to keep the grain moving into Rome found it necessary to compensate the shipping men by the offer of special inducements.[62] These inducements were insurance against losses at sea, exemption from the Lex Poppaea relating to succession, and the privileges of Roman citizenship to all Latins engaged in the grain traffic for 6 years. Even these proved an inadequate compensation for the loss of profits resulting from the diversion of shipping from Puteoli to Ostia. Some years later the men were further compensated in the form of tax-exemptions. Nero saw the problem and attempted to find the answer in the construction of an inland water-way connecting Puteoli and Ostia, thereby making it possible for large ships to put in at Puteoli where return cargoes were available.[63] Then too, the necessity of the expensive transportation of the grain from Puteoli to Rome by highway would be avoided, or the equally inefficient trans-shipment by way of Tarracina in small boats pulled along by donkeys. The moderately-sized boats that would be em-

[62] Information about the compensations granted to ship owners by Claudius is given us by Suetonius, *Claudius* 18.9; Gaius 1.32; Ulpian 3.6: nave Latinus civitatem Romanam accipit, si non minorem quam decem milium modiorum fabricaverit, et Romam sex annis frumentum portaverit, ex edicto divi Claudii. Cf. Rostovtzeff, *Storia economica* 186; Frank, *Economic History* 304; H. J. Loane, *Industry and Commerce of the City of Rome* (Baltimore, 1938) 15 f. A. Momigliano, *Claudius* (English translation, H. W. Hogarth, Oxford, 1934) 107–8; A. M. Duff, *Freedmen in the Early Roman Empire* (Oxford, 1928) 44, 46, 83.

[63] Nero's canal scheme: Tacitus, *Ann.* 15.42; Pliny, *NH* 14.61; Suetonius, *Nero* 31; cf. Dubois, *Pouzzoles Antique* (Paris, 1907) 79; F. H. Wilson, *op. cit.* 50.

ployed on Nero's canal could by-pass Ostia and need not be unloaded until they reached Rome.[64]

Nero's scheme was considered wild by his contemporaries, and by some modern writers, but was economically sound, and if carried into effect might have been an excellent investment and might have had very beneficial consequences for Rome, for Puteoli, and perhaps for Italy as a whole.

We have seen that the development of Ostia as a great port was artificial and resulted in actually raising the freight rates on grain shipments to Rome. Puteoli, on the other hand, was a natural deep water port which was the outlet for one of the most prosperous agricultural and industrial regions of Italy. The export of Campanian products through this port — wine, oil, fruits, vegetables, pottery, glass, metal wares, perfumes, and other manufactured articles — is too well known to warrant comment. Similarly well situated for both the export and import trade were the ports of Naples and Pompeii.[65] The commercial advantages which the Campanian ports had over Ostia are clearly indicated by the unwillingness of the shipping men to change the Italian terminus of the grain-shipping route. The compensations which Claudius and Nero were obliged to give them amount to a significant increase in real shipping costs. It is not improbable that these costs were still further increased in 200 A.D. when five unions of shipmasters went on strike to back up their demand for higher rates.[66] One may safely assume, therefore, that any changes in the rates taking place during the third and fourth centuries were always in the upward direction. In all probability the rates on grain shipments to Italy were lower during the first century when the Campanian ports were

[64] Strabo 5.3.6. Pliny 14.6 (61) mentions the work on the canal which Nero commenced, in order to provide navigation from Lake Avernus to Ostia.

[65] Rostovtzeff, *Storia economica* 190 ff.; Oliva, *op. cit.* 233. Situated on the banks of the Sarno about a mile from the sea, Pompeii drew all the commerce of Nola, Nocera, and Acerra (Strabo 5.4.8: Νώλης δὲ καὶ Νουκερίας καὶ Ἀχερρῶν . . . ἐπίνειόν ἐστιν ἡ Πομπηία, παρὰ τῷ Σάρνῳ ποταμῷ καὶ δεχομένῳ καὶ ἐκπέμποντι. Cf. Frank, *ESAR* 5.252, note 89.

[66] In 200 A.D. a rise in shipping rates probably did take place after the strike of the 5 unions of shipmasters at Arles. They demanded an increase in the rates on the grain cargoes carried by them to Rome. Cf. W. H. Buckler, "Labor Disputes in the Province of Asia," *Anatolian Studies Presented to Sir William Ramsay* (Manchester, 1923) 27; *Digest* 50.6.6.3–9; Dessau, *ILS* 6987; Cagnat, *Comptes rendus de l'Académie des Inscriptions et Belles-Lettres* (1899) 353; Waltzing, *Étude historique sur les corporations professionelles chez les Romaines* (Louvain, 1895–1900) 3.526; 4.616–623.

still used than during any subsequent period, that is, lower than the rates quoted in the new fragments of the *Edict*.

If that was actually the case, one would be justified in drawing attention to the probability that the cheapness of water transportation rendered feasible the shipment of Egyptian and African grain not only to Rome but also to other maritime cities of Italy, particularly to those flourishing industrial cities situated along the coast of Campania. The competition of cheaply transported Egyptian and African grain produced in great volume and at very low cost had, after the conquest of Sicily and Africa, been bringing about a gradual but perceptible decline of cereal production in Latium and Campania.[67] It was far easier and cheaper for Rome to import wheat by sea than to transport it from the rich grain fields of Italy. Italian grain-growing was profitable only in the interior of the country and was limited to supplying the needs of cities and towns nearby and to feeding the slaves and livestock of the villas and farms. Vineyards and olive plantations, orchards and stock farms became the dominant forms of agriculture in Latium, Campania, and other parts of Italy. All of these new branches of agriculture Cato, having in mind Latian and Campanian agricultural conditions, listed in preference to grain fields.[68] The same was true of the time of Domitian.[69] A large proprietor, to whom Statius addressed the second book of his *Silvae* (2.6), possessed estates near Vesuvius, in Liguria, in Lucania, and by the Tiber, but his wheat lands, Statius expressly says, were not in Italy but in Crete and Cyrenaica. One

[67] The development of Italy from a grain land into a garden is described by Mommsen, *Röm. Gesch.* 1.839 ff., Wiskemann, *Die Antike Landwirtschaft* 50 ff., H. Nissen, *Ital. Landeskunde* 1.444, 450; 2.91. Since the 2nd century B.C., arable farming had been declining, and Italy ceased to be primarily a grain producing country. Cf. Rostovtzeff, in *RE* s.v. "Frumentum."

[68] Cato (*RR* 7) placed viticulture first, gardening second and grain fourth in order of profit. According to Cicero (*Off.* 2.25.89) Cato expressed himself strongly against grain growing as an investment. Cf. Pliny, *NH* 18.29; E. H. Oliver, *Roman Economic Conditions to the Close of the Republic* 59; H. Last in *CAH* 9.4 ff. and notes 5 and 27.

[69] According to Suetonius (*Domitian* 7.2, 14.2) Domitian in the year 93 issued an edict halting the extension of vineyards throughout Italy in order to make more land available for cereals. Cf. Statius, *Silvae* 4.3.11–12: Qui castae Cereri diu negata reddit jugera sobriasque terras. But cereal producers received very small returns according to Martial (12.76: Modius datur aere quaterno, i.e. a half bushel of grain was equal in value to the admission charged to 4 Roman boys at a penny bath. Cf. Juvenal 2.152: nec pueri credunt, nisi qui nondum aere levatur). Domitian's edict has been fully discussed by Reinach, "La Mévente des vins sous le Haut-Empire romain," *Rev. Archéol.* 39 (1910) 350 ff.; and by Billiard, *La vigne dans l'antiquité* (Lyon, 1913) 105 ff.

other factor besides transportation contributing to the gradual abandonment of grain growing was the extensive use of slave labor in Italy after the Roman conquests. Slave labor is remunerative in agriculture only when it can be put to steady and continuous use.[70] Whereas vines, olives, and live stock demand attention at all seasons and can put slave labor to profitable use, grain growing calls for intense activity only at planting and harvest time but not during the growing season and the rest of the year. Few large estates worked by slave labor could afford to grow cereals in excess of that needed for household and feeding purposes. Even less profitably could cereal production be carried on during the imperial period when the Empire had ceased to expand and the last of the lands had been conquered in which fresh slaves might be recruited for toil on Italian farms. A dwindling and expensive slave force might more profitably be set to work producing wine, oil, and perfumes for the export trade than in growing grain which could be more abundantly and cheaply grown in Egypt and Africa and landed for low freight rates at the ports of Western Italy. It is difficult to think that the populace who joyously and excitedly awaited the arrival and watched the unloading of the Alexandrian grain boats were not acting in the belief that the grain was being landed for themselves.[71] Nor can one argue from the lack of literary and epigraphical evidence that like crowds did not assemble to watch African and Sicilian ships at the wharves of Naples and Pompeii.

APPENDIX

(a) The average price of wheat in Egypt from 225–200 B.C. was 4 silver drachmae per artaba (data supplied by Heichelheim, *Wirtschaftliche Schwankungen* 120–121). If the artaba was equal to $3\frac{1}{3}$ Roman modii (Johnson, *ESAR* 2.466), and the silver drachma was worth $\frac{4}{5}$ of a denarius (Hultsch in *RE* s.v. "Drachme" 1613–33), the price in Roman money must have been about 3.8 HS per modius. If a higher conversion factor is used, 4 instead of $3\frac{1}{3}$ modii to the artaba, the average price for that period would not be greater than 3 HS per modius. From 150 B.C. to the time of Augustus, the average price per artaba was about 1150 copper drachmae = 2.3 silver drachmae = 2.2 HS per modius, or 1.8 HS per modius if the higher conversion factor is used. Heichelheim (118–122) believes that the Egyptian wheat price in 150 B.C. was about $1\frac{1}{4}$ HS per modius, but in Cicero's time varied from $2\frac{1}{2}$ to 5 silver drachmae per artaba = 2.4 — 4.8 HS per modius. Using the data supplied by Johnson (*ESAR* 2.310 f.), we find that the average price of wheat in Egypt during the first century A.D. was about 6 drachmae

[70] The revolution in Italian agriculture from grain growing to vines and olives was brought about partly by the introduction of slavery. See Rostovtzeff, *Storia Economica* 19 ff.; G. Acerbo, "L'agricoltura italica al tempo d'Augusto," *Istituto di Studi romani* (Roma, 1938, *Studi italiani* no. 8) 18.

[71] Seneca, *Epist.* 77; Oliva, *op. cit.* 233.

per artaba (somewhat less if we omit prices recorded for the years 45/46 and 79, when exceptionally high prices prevailed because of unusual flood conditions and local famines. (See Johnson, *op. cit.* 435). Setting the value of the drachma at $\frac{1}{4}$ denarius (Johnson, *op. cit.* 432 ff.), we get a value of 1.8 HS per modius (which supports Frank's statement in *ESAR* 1.403), a somewhat lower value than Segrè's estimate of 2.4 — 3.6 HS per modius in his *Circolazione monetaria e prezzi nel mondo antico* (Roma, 1922). A study of the evidence for Egypt reveals that wheat prices were relatively low during the reign of Augustus, that they slowly but steadily rose towards the end of the first century and that in the second century they were materially higher than during the first.

(b) On wheat prices in Sicily, see Scramuzza, "Roman Sicily," *ESAR* 3.255, esp. 264 ff.; Rostovtzeff in *RE* s.v. "Frumentum" 146; J. Carcopino, "La Sicile agricole au dernier siècle de la République Romaine," *Vierteljahresschrift für sozial- und Wirtschaftgeschichte* 4 (1906) 142–147; Corsetti, "Sul prezzo dei grani nell' antichità classica," *Studi di storia antica* 2 (Roma, 1893) 90; Drumann-Groebe, *Geschichte Roms* 5 (1919) 296 note 10. We are well informed on wheat prices in Sicily for the time of Cicero only. The lowest price on the free market was 2 HS per modius (Cicero, *Divin. in Caecil.* 30: cum esset tritici modius sestertiis binis; cf. *Verr.* 2.3.194, 196, 201), a price which Verres admitted in letters to his friends to have paid (*Verr.* 2.3.174, 189). The highest price in normal years was 3 HS per modius according to Cicero (*Verr.* 2.3.189), a price not always maintained (*Verr.* 2.3.191: cum HS ternis tritici modium vendere non possent; cf. *ibid.* 196). At times, the free market price fluctuated wildly as a result, perhaps, of crop failures (*Verr.* 2.3.227), piracy, war, or corrupt administration (Frank, *ESAR* 1.402). It was subject to seasonal variations (Scramuzza, *op. cit.* 3.265) and was not uniform throughout Sicily (*Verr.* 2.3.194). The price of wheat on the free market varied in normal times from 2 to 3 HS per modius (Scramuzza, *op. cit.* 3.266; Rostovtzeff in *RE* s.v. "Frumentum" 146).

A legal, or official, price was established by the Roman government which was higher than the free market price and which the governors were required by law to pay the Sicilian farmers (*Verr.* 2.3.174, 163): 3 HS per modius paid for the decumanum or second tithe delivered for cash, while the first tithe was delivered to the Roman state as tribute levied upon 57 cities; $3\frac{1}{2}$ HS paid for requisitioned wheat (imperatum); 4 HS paid for wheat for the use of the governor's staff (frumentum in cellam). The average official price was about 3.1 HS per modius; 3,000,000 modii were delivered at 3 HS per modius, 800,000 at $3\frac{1}{2}$, and about 50,000 at 4 (Scramuzza 262), a price sufficiently high to have a steadying effect upon the Sicilian market, to provide a bonus for farmers as an incentive to grow more grain and thereby to secure for Rome an unfailing source of supply in time of war or bad harvests in Italy. This price Rome could afford to pay since she was receiving from Sicily a total of 7,000,000 modii at a cost of slightly less than $1\frac{3}{4}$ HS per modius, plus the cost of transportation. Frank (*ESAR* 5.293) suggests 9,000,000, cf. Scramuzza, *ESAR* 3.350. See above, note 30.

(c) On wheat prices in Rome see above, note 9. The opinion of most scholars is that wheat prices for the periods of Cato and Cicero and for the first century A.D. were normally about 3 HS per modius, never above 5 (Frank, *ESAR* 1.98, 192, 283, 402; Rostovtzeff in *RE* s.v. "Frumentum" 148 ff.; Oliva, *op. cit.* 95, 168; Marquardt, *Das Privatleben der Römer* 398). Jasny (*op. cit.*), however, argues that the prices for flour quoted by Pliny (*NH* 18.10.90) imply much higher grain prices in a free market (8 HS for *similago* and 10 for *siligo*) than usually believed. Frank (*ESAR* 1.403) thinks that Pliny's flour prices mean "a rather high price of 5 HS the modius for wheat." Rostovtzeff (*op. cit.* 149) concludes that the flour prices can easily be made to agree with a wheat price of 3–4 HS, which is known from other sources. Technically Jasny may be right, but it can be shown, I think, that the prices of grain for the period ca. 75 A.D. are not typical prices for the Republic, the early Empire, or even of the third century.

The *Annals* of Tacitus reflect a tendency in the direction of higher grain prices, a tendency beginning with the policy of Augustus of regulating the supply and price of grain through the agency of the *negotiatores frumentarii* (*CIL* 6.814, time of Titus; *CIL* 14.2852, 139 A.D.; cf. Tac. *Ann.* 2.87; Suet. *Aug.* 42.3; Frank, *ESAR* 5.219 note 2; Loane, *Industry and Commerce of the City of Rome* [Baltimore, 1938] 64). The usual means of organizing the supply so that everybody in the city could buy at a reasonable and stable price was to grant bonuses to grain dealers to induce them to sell their grain. What the price of grain was on the free market in 19 A.D., when Tiberius gave the negotiatores a subsidy of 2 HS per modius so as to relieve the *saevitiam annonae* (Tac. *Ann.* 2.87), or in the year 64 when Nero depressed the price to 3 HS (*ibid.* 15.39.2), is not known but was probably close to 5 HS. That grain prices continued to follow a rising curve from 64 to 75 A.D. seems likely in view of the crisis that overtook Italian grain production in the reign of Domitian and that compelled Domitian to issue an edict in 92 checking the rapid extension of vineyards in order to make more land available for cereals. See above, note 69; Frank, *ESAR* 5.55, 141 f., 145, 182 f., 297.

The facts mentioned above tend to confirm the high grain prices revealed by Jasny's analysis of Pliny's flour prices, but these prices cannot be applied to all periods of the Empire, certainly not to the age of Diocletian, whose *Edict* set a maximum tariff on wheat at 100 denarii per castrensis modius = 85 cents a bushel (Frank, *History of Rome* [New York, 1923] 557, interprets 100 den. per KM as 75 cents per bushel, in *ESAR* 1.403 apparently 80 cents a bushel; but see above, note 49), an advance of only 20 or 25 cents a bushel beyond the price usually accepted for the time of Cato and Cicero and for the early years of the Empire. We conclude that grain prices based on Pliny's flour prices are not typical ones but merely reflect a temporary crisis in Italian agriculture during the last quarter of the first century.