Human Mobility in Roman Italy, II: The Slave Population*

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In the first part of this study, I attempted a quantitative reconstruction of migratory flows within the free population of Roman Italy from the early Republic to the early Principate.[1] Imperialism was the driving force behind these movements. The same is true of coerced transfers that complemented voluntary relocations. The transfer of slaves to Italy was ultimately a function of Roman imperialism, either directly, via military operations, or indirectly, via the accumulation of capital at the imperial core and the expansion of markets across the regions under Roman influence. In this paper, I seek to delineate the build-up of the Italian slave population.[2] Any attempt to quantify this process faces serious obstacles. Literary references to the number of slaves netted in various campaigns convey a sense of magnitude but are ultimately useless for establishing long-term totals.[3] Once again, only a parametric model can shed light on this issue. It must revolve around two variables: the probable number of slaves in Roman Italy, and the demographic structure of the servile population. In Section I, I critique existing estimates of slave totals and propose a new 'bottom-up' approach. Section II offers a discussion of the probable sex ratio, mortality regime, and family structure of the Italian slaves, followed by new estimates of the scale of slave transfers in Section III. According to my reconstruction, the total number of slaves in Roman Italy never exceeded one or at most one-and-a-half million. This population had been created by the influx of anywhere between two and four million slaves during the last two centuries B.C. Thus, while the servile element of the Italian population appears to have been significantly smaller than previously thought, the volume of the slave trade very probably exceeded the overall incidence of voluntary migration in that region.

I THE NUMBER OF SLAVES IN ROMAN ITALY

In the opening chapter of his *Inquiry into the State of Slavery amongst the Romans; from the Earliest Period, till the Establishment of the Lombards in Italy* of 1833, William Blair asserts that 'we may conjecture, with a prospect of tolerable accuracy, that the proportion of three slaves to one freeman is sufficiently low for the period between the conquest of Greece ... and the reign of Alexander Severus ... This would make the entire population of Italy, under Claudius, amount to — free, 6,944,000 — slaves, 20,832,000 — total, 27,776,000'.[4] Seven years later, Dureau de la Malle's *Économie politique des Romains* dismissed Blair's figure as mere speculation that failed to take account of the carrying capacity of ancient Italy, and proceeded to argue that in 225 B.C. Italy was home to 2,665,805 freeborn, 50,000 freedmen, and 2,262,677 slaves and aliens.[5] Even today, this debate is not as remote and irrelevant as it may seem. At first sight, and notwithstanding

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[1] 'Human mobility in Roman Italy, I: The free population', *JRS* 94 (2004), 1–26.

[2] For the potential impact of Roman imperialism on slavery in Greece, cf. K. Hopkins, *Conquerors and Slaves* (1978), 158–63; but cf. below, n. 58.

[3] e.g., W. V. Harris, *War and Imperialism in Republican Rome 327–70 BC* (1979), 59, 63, 81; A. Ziolkowski, 'The plundering of Epirus in 167 BC: economic considerations', *PBSR* 54 (1986), 69–80.

[4] ibid., 15–16.

[5] Vol. I, Book 2, chs 2–6.

JRS 95 (2005), pp. 64–79.

the bizarre precision of this figure, an estimate of 2,262,677 slaves and aliens appears vastly superior to one of over twenty million. However, unlike Dureau de la Malle, who primarily reasoned from putative carrying capacity (and thus aimed to 'fill up' a seemingly underpopulated countryside with a plausible number of slaves), Blair — however ineptly — took a more sensible route by seeking to extrapolate the extent of slave-ownership from putative demand. Unfortunately, Dureau de la Malle's approach carried the day. It is true that in 1886, Beloch still laboured hard to keep up the pretence that his slave total of two million — simply one-third of his Italian population of six million — was somehow derived from ancient evidence.[6] Brunt, who has no trouble demolishing this extraordinarily flimsy construct, avoids the hazards of specious manipulation of inadequate source material by proposing an estimate for Augustan Italy that does not purport to be based on any evidence at all: 'In my view we could put the number of slaves at about 3,000,000, out of a total population of no more than 7,500,000.'[7] I ought to stress that I do not, by selective quotation, suppress some vital context that would justify this particular choice, for there is none. This figure is imposed top-down, for the single reason that 'this hypothesis permits us to believe that the population of Italy had grown by 50 per cent since 225 B.C., though the increase was largely in the servile element'.[8] Unencumbered by any independent analysis, this 'hypothesis' is a direct function of a particular estimate of the number of Roman citizens.

The notion that slaves accounted for one-third of a given historical population has long been popular in those cases in which the actual share of slaves is thought to be significant but is actually completely unknown. Brunt notes in passing that in the Antebellum South, one-third of the population consisted of slaves. More explicitly, Finley observes that 'in 1860 the slaves made up 33% of the population of the southern states of the United States, a slightly lower percentage in Cuba and Brazil. On conservative estimates — 60,000 slaves in Athens at the end of the fifth century B.C., 2,000,000 in Italy at the end of the Republic — the comparable percentages are in precisely the same range, about 30 and 35%, respectively'.[9] However, it may not be particularly surprising that modern estimates for Greece and Rome should fall in 'precisely the same range' as statistics for the Americas: if the former had in any way been influenced by the latter, comparisons of this kind would be circular in nature and incapable of corroborating anything.[10] A recent article on slavery in late medieval Korea offers a rather unsettling parallel: 'For lack of statistical data, it is impossible to calculate the extent of the enslaved population, but rough estimates suggest that at the beginning of the fifteenth century, slaves constituted about 30 per cent of the total population.' Orlando Patterson, in his global comparative study of slavery, gathers a whole set of comparably shaky guesses favouring the same canonical proportion, from various West African societies all the way to South-East Asia. Under these circumstances, it seems almost inevitable to find a corresponding share of 35 per cent attributed to Egypt and Mesopotamia around 2300 B.C. as well.[11] With time, such constructs come to be taken for granted, if only because they tend to go unchallenged.[12]

[6] J. Beloch, *Die Bevölkerung der griechisch-römischen Welt* (1886), 415–18.

[7] P. A. Brunt, *Italian Manpower 225 B.C.–A.D. 14* (1971; repr. 1987), 124. Cf. T. Frank, 'Roman census statistics from 225 to 28 B.C.', *CP* 19 (1924), 341, who invents 4 million 'slaves and foreigners'.

[8] Brunt, op. cit. (n. 7), 125.

[9] ibid., 125; M. I. Finley, *Ancient Slavery and Modern Ideology* (exp. edn 1998, ed. B. D. Shaw), 148.

[10] Aggregate percentage rates are in any case fairly unhelpful for our understanding of large-scale slave systems. In 1860, 22 per cent of the population of the Upper South but 44 per cent of that of the Lower South consisted of slaves, while their share in individual states ranged from 1.6 per cent in Delaware to 57.2 per cent in South Carolina: P. Kolchin, *American Slavery 1619–1877* (1993), 242.

[11] M. Deuchler, 'Korea', in S. Drescher and S. L. Engerman (eds), *A Historical Guide to World Slavery* (1998), 246; O. Patterson, *Slavery and Social Death* (1982), 354–8; B. W. Higman, 'Demography', in Drescher and Engerman, 169.

[12] cf. K. Bradley, *Slavery and Society at Rome* (1994), 12, for 'the fact that the servile proportion of the population of Italy in the time of Augustus can fairly be estimated at 35 per cent, a figure comparable to that for Brazil in 1800 and for the United States in 1820'. There is no such 'fact'.

In truth, there is no way to infer overall Roman slave totals either from ancient sources or from carrying capacity. It is chastening to realize that studies published in 1833 and 1994 could refer to the same handful of texts as evidence of large-scale slave-holding among the Romans but accept dramatically different population estimates.[13] Realistic slave tallies cannot be invented out of whole cloth but must be pieced together from local counts. In the absence of formal slave censuses in the Roman Empire outside Egypt, the best we can do is to simulate the aggregative procedure of deriving grand totals from their constituent elements, i.e. from the bottom up. While this method inevitably entails huge margins of uncertainty, it provides a much-needed independent check on free-floating top-down guesses.

Non-Agricultural Slavery

What was the demand for slave labour in urban and other non-agricultural contexts? On a conservative estimate for the late Republican and early imperial periods, some 500 to 600 senators and at least 20,000 city councillors lived in Italy. Some of the decurions were knights, while other equestrians resided in Rome. Mainly for want of evidence, I follow Jongman in reckoning with 5,000 knights in addition to 20,000 councillors.[14] Averages of five domestic slaves for each decurion, of four times as many for each *eques*, and of four times as many again for each senator yield a total of at least 240,000 slaves.[15] Given that these figures include slave women and children, they are best regarded as minima. Élite groups beyond the three *ordines* would have owned additional slaves. The extent of sub-élite slave-ownership is unclear.[16] Comparative evidence documents a huge degree of variation: in the Antebellum South in 1860, 25 per cent of all slaves lived in units of one to nine slaves, compared to only 8.7 per cent in Jamaica in 1832.[17] In the cities of Roman Middle Egypt, 14.6 per cent of the individuals recorded in surviving census returns were unfree, and about one-fifth of urban households owned slaves, most of them just one or two.[18] If we apply the Egyptian rates to Italy, about 70,000 out of 350,000 urban households would have owned slaves.[19] Given a non-slave urban population of about 1.4 to 1.6 million, the Egyptian ratio of 1 slave per 5.8 free would suggest the presence of 240,000 to 275,000 slaves in the cities of Roman Italy. On the general assumption that slave-ownership was likely to be more widespread in Italy than in Egypt, this can be no more than a minimum even for sub-élite strata. Imperial and municipal slaves must also be added but probably played a minor role.[20] This indicates a minimum of around 500,000 non-farm slaves. Unless we assume that slave-ownership was a less vital element of Roman

[13] Blair, op. cit. (n. 4), 12 (cf. 15–16: 20.8 million slaves); Bradley, op. cit. (n. 12), 10–11 (cf. 30: 2–3 million): Plin., *HN* 33.135; Tac., *Ann.* 14.43; Apul., *Apol.* 93; Gai., *Inst.* 1.43; Pallad., *Hist. Laus.* 61.

[14] W. Jongman, *The Economy and Society of Pompeii* (1988), 193: 100 decurions for each of the largest 100 cities and 30 each for 330 others add up to 20,000. For a larger number of knights, see W. Scheidel, 'Stratification, deprivation and quality of life', in M. Atkins and R. Osborne (eds), *Poverty in the Roman World* (forthcoming).

[15] I derive the *decurioleques* ratio very crudely from the relation between the attested minimum property qualifications of these groups (HS 100,000 and 400,000, respectively). It is impossible even to guess by how much the average senatorial fortune exceeded the equestrian mean: however, due to the relatively small number of senatorial households, estimates of average senatorial slaveholding have only a weak effect on any aggregate tally of élite slave-ownership.

[16] cf. the inconclusive controversy about the number of slaves in Athenian hoplite households. T. W. Gallant, *Risk and Survival in Ancient Greece* (1991), 30–3, highlights the complexity of this issue.

[17] Kolchin, op. cit. (n. 10), 243.

[18] R. S. Bagnall, B. W. Frier and I. C. Rutherford, *The Census Register P.Oxy 984* (1997), 98; R. S. Bagnall and B. W. Frier, *The Demography of Roman Egypt* (1994), 49, 71.

[19] For the sake of simplicity, I assume no overlap with élite households. This may be justified by the fact that the Egyptian metropoleis that generated these data were much larger than the average Italian city, and the élite/sub-élite ratio was therefore higher. I argue elsewhere for a minimum of 40,000 *prima classis* households in Roman Italy (op. cit. (n. 14)).

[20] For instance, two dozen public slaves per city would be required just to reach a total of 10,000.

élite identity than usually believed, it is difficult to envision a significantly lower total. If anything, actual figures may have been higher. Even if Pedanius' notorious 400 household slaves are a purely symbolic figure, some senators may well have owned more than 80 domestic slaves: the Younger Pliny's provision for 100 of his freedmen is a good example.[21] Some slave-owning sub-élite citizens and aliens would have had more than two slaves, and we must also allow for unfree craftsmen in urban businesses. I see no way to advance beyond controlled speculation. A doubling of the minimum estimates raises the total to fully one million slaves, more than Hopkins' top-down guess of 800,000 for 28 B.C.[22] The metropolitan/non-metropolitan split likewise remains a matter of conjecture. If we schematically place all senatorial slaves, half of all equestrian slaves, and half of all sub-élite slaves in the capital, we arrive at approximately 220,000 to 440,000 slaves in Rome and 280,000 to 560,000 in the other cities. In the most general terms, the free population figures associated with the 'low' count would seem to favour estimates near the lower end of these ranges.[23] Moreover, a more pronounced (and to my mind highly plausible) concentration of slave-ownership in the top ranks of Roman society would help redress the apparent imbalance between centre and periphery. I should stress that even within the parameters of my minimum estimates, each member of the first class could probably have owned slaves; slaveholding would have extended somewhat into the lower echelons of society; and, allowing for disproportionately high ownership of agricultural slaves among members of the top orders, the average senator could easily have owned hundreds of slaves, and the average knight, dozens. Higher totals might be possible but are actually unnecessary for the creation of a very slave-rich environment.[24] Moreover, at least in the Principate, slaves did by no means come cheap.[25] For computational purposes, I adopt subtotals of 300,000 slaves each for the capital and the other cities. These values are merely meant to provide a baseline for secondary calculations of the required scale of imports. In view of the orders of magnitude involved, reasonably close alternatives would not greatly affect final outcomes.

Agricultural Slavery

A bottom-up approach holds greater promise for agricultural slavery simply because slave numbers can be related to levels of production and demand. Jongman has recently made an excellent point about the relatively small amount of Italian farmland that could conceivably have been devoted to plantation-style arboriculture. Thus, 100,000 hectares of vineyards, or one per cent of cultivable land in Italy, could have produced enough wine to supply each of two million urban consumers with a hectolitre of wine per year, while a similar amount of land was sufficient to cover annual per capita consumption of twenty litres of olive oil in the same population.[26] Thus, no amount of quibbling with details can alter the fundamental fact that, in terms of land use, the production of cash crops for the market must have been a marginal phenomenon. However, it is possible and indeed necessary to go one step further. Jongman neglects to relate his estimates to labour requirements. The lowest ratio of workers to land for vineyards documented in Roman sources assigns seven *iugera* to each slave.[27] In this scenario, 57,000 slaves were needed to cultivate 100,000 hectares of *vinetum*. Higher ratios of eight or ten to one translate to

[21] W. Scheidel, 'Finances, figures and fiction', *CQ* 46 (1996), 237 n. 34 (cf. Apul., *Apol.* 93). For Pliny, see *CIL* V.5262 = *ILS* 2927; they need not all have been domestics.

[22] Hopkins, op. cit. (n. 2), 68–9.

[23] See Scheidel, op. cit. (n. 1), 14–15.

[24] See also W. L. Westermann, *The Slave Systems of Greek and Roman Antiquity* (1955), 88–9, for some anecdotal evidence suggestive of relatively moderate levels of slave-owning even in privileged circles.

[25] See below, n. 75.

[26] Jongman, op. cit. (n. 14), 114 with references (rounded figures).

[27] Colum., *RR* 3.3.8.

lower totals of 40–50,000.[28] Alternatively, if we believe Cato's calculation that twenty-five hectares of vineyard could yield 3,300 litres of wine per hectare if worked by a staff of sixteen slaves that included supervisors and also produced their own food, 38,400 self-sufficient slaves on 60,000 hectares of land could have been enough to satisfy urban demand. However, his figure for yield seems on the high side, and may well refer to particularly favourable circumstances.[29] Nevertheless, all these estimates converge in a range from about 40,000 to 60,000 slaves in the wine industry.

Various confounding variables merit consideration. On the one hand, not all of the wine consumed in Italian cities was produced by local slaves: some was imported, some may have been produced by smallholders. On the other hand, slaves also made wine for export, at least up into the early Principate.[30] Prosperous farmers may have bought slave-made wine in the market, and the slaves themselves appear to have received some of it as well. To some extent, these factors cancel each other out. However, in order to establish a hypothetical maximum, we need to consider the logical implications of a concatenation of assumptions tailored to boost overall demand. If all of the wine consumed in the cities had been produced by slaves, rural demand for slave-made wine had equalled urban demand, and total exports had likewise equalled urban demand, the required labour force would treble in size, to 120,000 to 180,000 workers. Yet for a number of reasons, this estimate seems far too high. Exports of 200,000 tons of wine would mirror total grain imports to the city of Rome in terms of bulk as well as value.[31] Free farmers must have produced at least some of their own wine (and olives).[32] All in all, it seems hard to argue for a total in excess of 100,000 slave workers, at about twice the baseline figure. In the following, I use 50,000 and 100,000 as low- and high-end estimates for the contribution of (adult) slaves to viticulture.

Cato's ratio of 21.7 slaves per 100 hectares of olive trees translates to about 22,000 workers to supply two million consumers.[33] Because this kind of labour was highly seasonal and grain could be grown between the trees, these slaves were largely self-sufficient. The same qualifications apply as before. For computational purposes, I use a range from 20,000 to 40,000 (adult) slaves in oleoculture.

At this point, it is already clear that even the high-end tally of 140,000 slaves in arboriculture does not come anywhere near the 1.2 million or more rural slaves of modern scholarship.[34] What could the other million or million and a half have done to earn their keep? Two major upward corrections are feasible: our estimates of the number of workers may have to be raised considerably to account for slave children and perhaps even adult women who were excluded from the work ratios reported by Roman agronomists but were nevertheless present on large estates; and large numbers of slaves may have been involved in other kinds of agricultural activities.

On the unlikely assumption that the agricultural slave population of Roman Italy exhibited a 'normal' age and sex distribution, and only men aged, say, fifteen to sixty were considered proper workers, we would need to increase our estimates by as much as 235 per cent to cover women, children, and the elderly. However, the implied totals of 235,000 to 470,000 slaves are far too high. First of all, this scenario negates any possibility of manumission. Even if rural labourers were less likely to be freed than urban slaves, some

[28] Saserna ap. Varro, *Rust.* 1.18.2; Plin., *HN* 17.215. Cf. R. Duncan-Jones, *The Economy of the Roman Empire* (2nd edn, 1982), 331–2.

[29] Cato, *Agr.* 11.1; Duncan-Jones, op. cit. (n. 28), 327–8.

[30] A. Tchernia, *Le vin d'Italie romaine* (1986).

[31] 1 kilogram of grain (at HS3/*modius*) = HS 0.44 = 1 litre of cheap wine (at HS12/*amphora*; Duncan-Jones, op. cit. (n. 28), 364, on Pompeii). Average wine prices may well have been higher.

[32] cf. J. J. Rossiter, 'Wine and oil processing at Roman farms in Italy', *Phoenix* 35 (1981), 348; D. W. Rathbone, 'Roman farming', CR 35 (1985), 330; B. Ward-Perkins *et al.*, 'Luni and the *ager Lunensis*: the rise and fall of a Roman town and its territory', *PBSR* 54 (1986), 142.

[33] Cato, *Agr.* 10.1.

[34] Hopkins, op. cit. (n. 2), 68; cf. Brunt, op. cit. (n. 7), 124 (without breakdown).

attrition must have occurred. Second, slave fertility may well have fallen below replacement levels, which would have altered the ratio of children to adults.[35] Third, and perhaps most important, it is not at all self-evident that only men could work in vineyards and olive groves. Comparative evidence from more recent slave societies strongly suggests that the degradation or 'social death' of chattel slavery readily trumps conventional cultural reservations against women's involvement in field labour.[36] Moreover, as I argue in Section II, female slaves were probably sufficiently numerous to require active participation in production. Unfortunately, there is absolutely no way to estimate the probable share of women in the 'core' labour force of Roman wine and olive plantations. All we can say is that regardless of whether rural slavery was heavily dominated by adult men or large numbers of women were also present, the outcome remains the same: in the former case, the total number of slaves would not have greatly exceeded my initial estimates; in the latter, some of these women would have had to do farm labour in order to balance the books, and in doing so would have reduced the number of male slaves required to perform essential tasks. Either way, actual slave totals had to be much smaller than my hypothetical tallies of up to half a million. For example — and this is purely for the sake of illustration, if adult men had performed three-quarters of all work, and two-thirds as many women had covered the remaining quarter (i.e., at one-half of the male per capita rate), and the presence of children had corresponded to the proportion of adult females, and manumission had removed all elderly slaves,[37] the grand total would have amounted to 1¼ times the minimum estimates, or 125,000 to 250,000 slaves altogether. In any case, no even remotely plausible adjustment can deliver the vast number of additional slaves presupposed by existing top-down guesses.

Pastio villatica, pasturage, and other rural industries such as wood-cutting, brick-making, and mining would provide only limited employment for slaves. The scale of Italian cattle and sheep rearing should not be exaggerated, and did not require huge numbers of slaves: even if there had been as many sheep as people in Italy, they could have been tended by a few tens of thousands of shepherds.[38] In addition, women and minors were heavily involved in this kind of work, thereby reducing the presence of non-essential slaves.[39] *Pastio villatica* was particularly suitable for women and children, and would have provided work for slaves joined to adult men who were engaged in more physically demanding tasks.[40] Finally, there is no need to suppose that lumberjacks were usually slaves.[41] It seems unnecessary to assign more than 50,000 extra slaves to these sectors; yet even twice that number would not make a real difference to the grand total.

Grain farming alone could in theory have absorbed enough slaves to justify a much higher estimate. According to Columella, eight slaves (two ploughmen and six field labourers) could take care of fifty hectares of arable. Spurr has demonstrated that this arrangement would have kept them busy virtually year-round.[42] Yields exclusive of seed may have ranged from thirteen to twenty tons of wheat or wheat equivalent. Reckoning with a computational mean of 16.9 tons and 3.3 tons of consumption by these slaves and two supervisors or other staff per eight workers, the net yield is 13.6 tons, or enough to

[35] See below, Section II.

[36] W. Scheidel, 'The most silent women of Greece and Rome: rural labour and women's life in the ancient world', *G&R* 42 (1995), 213, and *G&R* 43 (1996), 1, 3–5, 8.

[37] So that men = n, women = $0.5n$, and children = $2(0.25n)$, given that children equal ¼ of adults.

[38] Varro, *Rust.* 2.10.11 cites ratios of 1 herdsman per 80 to 100 sheep, but fewer for large flocks; 2 men were needed for 50 mares. For the nature of Italian pastoralism, see P. Garnsey, *Cities, Peasants and Food in Classical Antiquity* (ed. W. Scheidel) (1998), 166–79; cf. N. Morley, *Metropolis and Hinterland* (1996), 151–8.

[39] Varro, *Rust.* 2.10.1–7; Scheidel, op. cit. (n. 36, 1996), 3–5.

[40] W. Rinkewitz, *Pastio Villatica* (1984).

[41] R. Meiggs, *Trees and Timber in the Ancient Mediterranean World* (1982) is not helpful.

[42] Colum., *RR* 2.12; M. S. Spurr, *Arable Cultivation in Roman Italy c.200 B.C.–c.A.D. 100* (1986), 136–40.

feed sixty-eight people at 200 kg/year.[43] Some of these consumers may have resided on the estate: if we doubled or trebled the number of slaves to account for women and children, those fifty hectares could still have supported between forty-eight and fifty-eight outsiders.[44]

If all slaves in viticulture had been fed by grain produced by other slaves, not more than 3,250 km² of arable farmed by 65,000 workers and staff (and occupied by up to another 150,000 slaves) would have been necessary to meet their demands. More plausible estimates range from 1,000 to 2,000 km² with 20–40,000 workers and perhaps 50–100,000 slaves overall. Besides, some of this grain might have been bought from free farmers. Nonetheless, even the most extreme assumptions about rural slave numbers in various sectors could not raise the grand total much beyond three-quarters of a million.[45] As a consequence, it is simply impossible to argue that the Italian countryside was populated by over a million slaves, unless one also believes that slave labour dominated the urban grain supply. In fact, top-down guesses of two to three million slaves in Italy logically imply that the *entire* urban population outside the capital exclusively depended on slave-grown grain. In this case, aggregate demand for 200,000 tons of grain would have been met by 200,000 additional workers and staff, or up to 650,000 slaves including family members, for a new grand total of up to 1.4 million rural slaves. Nobody has ever advocated so extreme a scenario.[46]

This is not to say that slave labour could not have played a significant role in arable cultivation. As Spurr and I have argued on previous occasions, slave labour was perfectly compatible with 'rational' market-oriented grain production.[47] Columella in particular offers a variety of observations that betray his familiarity with large slave-staffed *frumentaria*.[48] Moreover, according to the 'low count' reconstruction of Italian demography, the ratio of the gross non-metropolitan urban population to the rural free population may at least temporarily have dropped as low as one to two in part of the first century B.C.[49] This would imply remarkably large grain surpluses among Italian farmers (or, perhaps more likely, urban residence of many farmers). One might argue that the ongoing shift from the countryside to the cities relieved pressure on arable land and led to improved land-to-labour ratios and productivity. Alternatively, or in addition, labour-efficient slave-estates that benefited from economies of scale could easily have delivered large quantities of marketable staple foodstuffs such as grain and legumes. Unfortunately, we can only speculate about the size of their contribution. For a minimum estimate, I assume that 10 per cent of urban demand was covered by such enterprises, staffed by no more than 20,000 workers and supervisors and 40,000 slaves altogether. A high-end guess

[43] Spurr, op. cit. (n. 42), 137 assumes a split of 12.5 ha of grain, 12.5 ha of legumes, and 7.5 ha of trimester. I reckon with 5 *modii* seed per *iugerum* seed (Colum., *RR* 2.9.1, 5, 15) and 5:1 gross yield. Actual yield averages may have varied from 4:1 to 6:1, with more pronounced local variations: cf. the comparative data in Spurr, 85–8. I accept Cato's very high rations for field hands (4–4.5 *modii*/month) and other staff (3 *modii*/month) (*Agr.* 56). For average wheat consumption levels, see Garnsey, op. cit. (n. 38), 230. I also allow for some wastage.

[44] See above. For slave women and children, I assume a *per capita* consumption of 200 kg/year including spoilage.

[45] viz., 470,000 in arboriculture, 210,000 in supporting arable farming, and 100,000 in other occupations.

[46] Among other problems, it would leave no room for farm tenancy: cf. P. W. de Neeve, *Colonus* (1984). A. M. Andermahr, *Totus in Praediis* (1998), 125 observes that in inscriptions referring to senatorial estates in Italy, *actores* greatly outnumber *vilici*, although the latter are otherwise more frequently attested than the former: thus, if J. Carlsen, *Vilici and Roman Estate Managers until AD 284* (1995), 130–42, is right to associate *actores* with tenancy and *vilici* with slaves, this might indicate that, at least in the Principate, senators relied heavily on free labour.

[47] Spurr, op. cit. (n. 42), 133–43; W. Scheidel, 'Grain cultivation in the villa economy of Roman Italy', in J. Carlsen *et al.* (eds), *Landuse in the Roman Empire* (1994), 159–66. For analogies, cf. J. R. Irwin, 'Exploring the affinity of wheat and slavery in the Virginia Piedmont', *Explorations in Economic History* 25 (1988), 295–322, and further references in my 1994 paper.

[48] Colum., *RR* 1.6.23; 1.7.6; 2.12.1–8 (cf. Varro, *Rust.* 1.19.1); 2.14.7; 2.20.4; 2.20.6, with Scheidel, op. cit. (n. 47), 163–4. Contrary to the *communis opinio*, it is not true that Columella associated arable cultivation with small-scale farm tenancy: W. Scheidel, *Grundpacht und Lohnarbeit in der Landwirtschaft des römischen Italien* (1994), 83–129.

[49] See Scheidel, op. cit. (n. 1), section IV.

of one-half of urban supply and a larger share of non-workers yields up to 300,000 extra slaves in the countryside. Incidentally, the presence of a large number of grain-producing slaves in the Italian countryside would make it easier to counter Lo Cascio's claim that the 'low' count is implausible because it does not allow for concurrent population growth in the urban and rural sectors of Roman Italy.[50] In terms of per capita output, these slaves were functionally equivalent to a much larger number of family farmers. Therefore, their higher productivity could have offset the numerical decline of the free rural population in the late Republic.[51]

A bottom-up perspective suggests that even under somewhat extreme assumptions, the rural slave population of Italy was highly unlikely to have exceeded one million. Defensible estimates range from a quarter-million to three-quarters of a million rural slaves.[52] In the next section, I argue for a substantial presence of slave women and children, and moderate manumission rates. Therefore, I opt for an above-average baseline range of 500–700,000 for my discussion of the slave trade, with 600,000 as a computational mean. A smaller slave total would imply fewer women and children and also lower rates of natural reproduction that would, in turn, necessitate larger imports of new slaves. As I formally demonstrate in Section III, relatively high fertility in a relatively large slave population and lower fertility among a smaller number of slaves generate similar inflow requirements. In consequence, my computations of overall transfer requirements are only mildly sensitive to the underlying estimates of slave numbers.

II THE DEMOGRAPHIC STRUCTURE OF THE ITALIAN SLAVE POPULATION

The age and sex distribution of the slave population of Roman Italy was a function of three factors: mortality, fertility, and migration. Fertility, in turn, was strongly determined by sex ratios and family structure. In order to estimate probable levels of immigration, we need to have some rough idea about the other two variables, as well as the size of the slave population.[53]

Sex Ratios

We must distinguish between the sex ratios of the slave trade and of the target population. As a general rule of thumb, they tend to converge over time: while imports may consistently be skewed in favour of one sex, slave births will gradually move the overall ratio towards a balanced distribution. This process can unfold with considerable speed. To name just one example, despite the fact that two-thirds of the slaves shipped to North America were male, the servile sex ratio in South Carolina fell from 170 (i.e., 170 men per 100 women) in 1705 to 130 in 1775, and from 150 to 120 in Chesapeake in the same period.[54] In a less fertile slave population, this process would take longer. Ever since the great Italian wars of the late fourth and early third centuries B.C., Roman imperialism had generated large and growing numbers of slaves. By the end of the Republican period,

[50] E. Lo Cascio, 'The population of Roman Italy in town and country', in J. Bintliff and K. Sbonias (eds), *Reconstructing Past Population Trends in Mediterranean Europe (3000 BC–AD 1800)* (1999), 163.

[51] Moreover, comparative evidence leaves no doubt that urban and rural growth rates could widely diverge for a long time: between 1600 and 1750, the urban population of England increased by 260 per cent, compared to 20 per cent rural population growth: E. A. Wrigley, *People, Cities and Wealth* (1987), 162. And England lacked slave-staffed estates.

[52] Using the low-end estimates and the high-end estimates, and a 1.75 multiplier (cf. n. 37).

[53] The following discussion develops an alternative scenario to W. V. Harris, 'Demography, geography and the sources of Roman slaves', *JRS* 89 (1999), 62–75. I believe that my main points obviate the need for a more elaborate rebuttal of his views. For further discussion of slave demography in the Empire as a whole, see my 'The Roman slave supply', in K. Bradley and P. Cartledge (eds), *The Cambridge World History of Slavery* I (forthcoming).

[54] P. D. Morgan, *Slave Counterpoint* (1998), 82.

Roman chattel slavery had long been a massive and well-established institution. For purely mathematical reasons, it is therefore highly unlikely that by that time overall sex ratios had not gradually approached a balanced distribution regardless of the sex ratio of the slave trade. This point is of paramount importance for our understanding of any mature slave system.[55]

Moreover, there is no good reason to assume that the Roman slave trade was dominated by males. Women and children would more frequently survive military defeat than adult men, and were therefore more likely to turn up in the slave markets. Females were also at greater risk from exposure after birth, and thus more liable to be picked up by slave-dealers or private individuals and reared as slaves. Ancient sources almost stereotypically report the enslavement of women and children in times of violent conflict.[56] The topical nature of these references strengthens rather than qualifies my case. The application of this stock motif even in legendary cases strongly suggests that ancient authors considered the enslavement of non-combatants a natural outcome of war: thus, when the annalistic tradition credited Tarquinius Priscus with the capture of the cities of Arpiola, Corniculum, and Suessa Pometia, it had most men perish but women and children being led off as slaves.[57] Unless non-Italian customers bought up all the women and children and left only men for the Italian market,[58] female slaves headed for the heartland of the empire need not have been outnumbered by men.[59] Because of this, and in view of the balancing effect of slave reproduction, it would be entirely unjustified to posit a seriously slanted age distribution among slaves in late Republican and early imperial Italy.

The best ancient evidence for servile sex ratios draws a similar picture. As I have pointed out before, the published census returns from Middle Egypt record twenty-two male and thirty-one female slaves up to the age of thirty. Virtually all male slaves had been manumitted by that age, whereas women were kept in slavery until menopause. This pattern shows that servile sex ratios in the Roman Empire did not have to be high, and that

[55] Harris, op. cit. (n. 53), 70, concedes this point in principle but *de facto* only for Roman slavery in 'the era of Justinian, or even of Diocletian' (70 n. 62). No explanation is given for this 600–800-year long delay, which is in any case inconsistent with the probable sex ratio of war captives (see below). Cf. also below, Table 1, for low sex ratios in the high-attrition environment of Caribbean plantations just a few years after the end of the Atlantic slave trade.

[56] e.g., App., *Kelt.* 11; *Samn.* 6.1; Liv. 31.27.3; Paus. 7.16.8; Sall., *Iug.* 91.7; App., *Illyr.* 16; Strabo 4.205; Tac., *Ann.* 13.39.6–7; Joseph., *BJ* 3.304, 4.488, 7.208; Herodian 3.9.11; Procop., *Vand.* 2.21.14; *Goth.* 1.10.29. Cf. also App., *BC* 4.64; Augustin., *Epist.* 10*. For non-Roman analogies, see, e.g., Paus. 3.10.4; Diod. 15.79.6, 16.34.3, 17.46.4, 17.70.2 & 6; Just., *Epit.* 9.2.15; Arr., *Anab.* 2.27.7, 4.2.4; Polyb. 9.39.2–3, 28.14.4; Liv. 43.19.12 (with 43.20.3); 1 *Macc.* 1.32; Zosimus 5.5.6; Procop., *Goth.* 2.21.39. Harris's unreferenced claim that 'male war-prisoners are likely to have been more numerous than female' (op. cit. (n. 53), 70) only makes sense if it is confined to combatants.

[57] Dion. Hal. 3.49.3, 3.50.6, 4.50.4; cf. 10.26.3.

[58] From 1650 to 1900, West African captor societies exported male slaves and kept females because European merchants paid higher prices for males whereas locals preferred females; East African captor societies exported slave women despite strong local demand for them, because Islamic merchants paid even higher prices: P. Manning, *Slavery and African Life* (1990), 41–6. Disproportionate demand for female slaves was ultimately driven by polygyny, which was not common in the ancient Mediterranean. This leaves the possibility that non-Italians in search of male slaves were outbid by Italians. However, it is unclear if the rising cost of full (as opposed to conditional) manumission for men in the manumission inscriptions of Delphi and Calymnia (200–1 B.C.) was a consequence of Roman (Italian) demand for male slaves or of improved mobility among fully freed men: Hopkins, op. cit. (n. 2), 159, 162 (or perhaps merely an artifact of recording practices: R. P. Duncan-Jones, 'Problems of the Delphic manumission payments 200–1 B.C.', *ZPE* 57 (1984), 203–9). More importantly, rising prices for male slaves might just as well reflect *falling* sex ratios in the slave trade: in fact, they are logically compatible with virtually any conceivable sex ratio.

[59] Imbalances between city and countryside in the target regions are another matter, but again, we lack usable evidence.

the reproductive capacity of slaves was valued by their owners.[60] It is true that these data come from a different region and a later period, and cannot prove anything about late Republican Italy. Unfortunately, neither can records from Italy itself. Some epigraphic sources from that region display male-biased sex ratios among slaves. However, we simply do not know what this means: whereas census declarants were compelled to report the actual membership of their households, wealthy patrons who commissioned epitaphs for their slaves were at liberty to be more discriminating. 77 per cent of the commemorated household staff of Livia were male, as were 66 per cent of the commemorated town slaves of two other aristocratic clans.[61] 'Commemorated' is the operative term. Equally high sex ratios among free persons whose names were deemed worthy of epigraphic preservation are known from other parts of the ancient Mediterranean. Perhaps the most famous example is furnished by the citizenship inscriptions from Hellenistic Miletus, in which the sons of newly naturalized mercenaries outnumber daughters four to one. This dramatic imbalance has repeatedly been interpreted as a sign of strikingly high rates of femicide.[62] The under-reporting of very young girls even in the census returns of Roman Egypt and the patriarchal habit of considering oneself childless unless endowed with a son suggest a less dramatic explanation: instead of jumping to the radical conclusion that girls were valued so little that they were regularly killed or exposed, we might want to consider the possibility that they were merely undervalued enough to be passed over in silence.[63] Neo-Babylonian cuneiform records from the seventh to fourth centuries B.C. mention some 45,000 individuals by name, including 1,200 privately-owned slaves. Of the latter, 850 are men and 360 are women, a ratio of 2.4 to 1. At the same time, we know from the same corpus of evidence that most male slaves had wives and children.[64] This apparent paradox disappears once we accept that men are simply much more likely to be referred to by name than women. High sex ratios in Roman inscriptions should perhaps be explained in the same way.

Whereas there is no evidence in favour of a high sex ratio in the slave trade, ancient sources stress the availability of women and children. Since there is no sign of a particularly slanted distribution of incoming slaves, there is similarly no reason to assume that it would have taken natural reproduction many centuries to eradicate any existing imbalances. In short, nothing supports the assumption that slave sex ratios posed a major obstacle to successful reproduction.

[60] Bagnall and Frier, op. cit. (n. 18), 342–3; W. Scheidel, 'Quantifying the sources of slaves in the early Roman Empire', *JRS* 87 (1997), 160–3. In order to defend the prevalence of high sex ratios, Harris, op. cit. (n. 53), 71, is compelled to dismiss the representative nature of this evidence. R. S. Bagnall, 'Missing females in Roman Egypt', *SCI* 16 (1997), 121–38, thinks that lots of young girls were exposed and raised as slaves (*contra* Harris's unreferenced claim that 'males were probably in the majority ... among ... foundlings': op. cit. (n. 53), 70): if true, this, too, would surely suggest some appreciation for female slaves (as opposed to daughters). *Pace* Harris, a lower prevalence of manumission for women in metropolitan inscriptions cannot be put on the same footing: see below. Harris also invokes the fact that 63 per cent of freed slaves recorded in the Delphi manumission inscriptions (second/first century B.C.) are women: however, this can mean that (a) female slaves were more likely to be manumitted than males (as Harris seems to imply); (b) there were more female slaves than males; or (c) neither. By themselves, these data cannot corroborate either (a) or (b).

[61] Harris, op. cit. (n. 53), 69.

[62] S. B. Pomeroy, 'Infanticide in Hellenistic Greece', in A. Cameron and A. Kuhrt (eds), *Images of Women in Antiquity* (1983), 207–22; P. Brule, 'Infanticide et abandon d'enfants: pratiques grecques et comparaisons anthropologiques', *DHA* 18 (1992), 53–90.

[63] cf. Bagnall and Frier, op. cit. (n. 18), 334. See also W. Scheidel, 'What's in an age? A comparative view of bias in the census returns of Roman Egypt', *BASP* 33 (1996), 25–59, at 34–48, and 'Sex ratios and femicide in the ancient Mediterranean world' (in preparation).

[64] M. A. Dandamaev, *Slavery in Babylonia* (1984), 218, 406.

Mortality

This factor is empirically unknown. Occasional claims that ancient slaves must on average have led shorter lives than the free population are pure speculation and logically presuppose that legal status was a critical determinant of life expectancy.[65] This assumption flies in the face of what we know about living conditions in pre-modern societies. Prior to the rise of modern hygiene and medicine, material assets and social standing did not automatically improve longevity. As I have argued elsewhere, Roman emperors who died of natural causes, senators and city councillors did not live notably longer than others.[66] More generally, there is no good evidence for a significant correlation between wealth and longevity until the eighteenth century.[67] Exposure to infectious disease was a much more important variable. Thus, slaves in the US outlived their fellow-sufferers in the Caribbean or Brazil mainly because of a less malign disease regime. Similar differences can be observed between slaves' longevity in the malarial rice swamps of the Carolinas and in the healthier interior of the Upper South.[68] In Roman Italy, urban slaves inhabited the same houses as their owners, ingested the same water, and were bitten by the same insects. Miners and gladiators were hardly typical of the slave population as a whole. Thanks to lower levels of population density and (where applicable) higher altitudes, country life is usually associated with above-average life expectancy. However, Sallares has argued that, to the extent that rural slaves were deployed in the low-lying and increasingly malarious plains of western central Italy, they may indeed have faced elevated risks of morbidity and mortality.[69] This raises an important point. If slaves were disproportionately likely to live in cities and in insalubrious parts of the countryside, their mean life expectancy would indeed have fallen short of the regional aggregate mean. Even in the absence of other constraints, this factor alone would have been sufficient to forestall natural reproduction at replacement level. This disadvantage did not arise from their legal identity *per se*; instead, it was an indirect consequence of the fact that for them lack of freedom dictated place of residence.

Comparative evidence from mature Caribbean slave systems indicates a strong nexus not only between sex ratios and birth rates but also between death rates and natural growth rates (Table 1).

TABLE 1: DEMOGRAPHIC INDICES FOR FIFTEEN CARIBBEAN SLAVE POPULATIONS (1816–1832)[70]

	Sex ratio	CBR	CDR	Natural increase (per 1,000)
Group 1	89 (1)	28 (1)	26 (1)	0.2% (1)
Group 2	115 (4)	23 (4)	32 (3)	-0.9% (3)
Grenada	93 (2)	26 (2)	37 (4)	-1.1% (4)
Group 3	96 (3)	25 (3)	28 (2)	-0.3% (2)

[65] Harris, op. cit. (n. 53), 71; L. Schumacher, *Sklaverei in der Antike* (2001), 42.

[66] W. Scheidel, 'Emperors, aristocrats, and the Grim Reaper: towards a demographic profile of the Roman élite', *CQ* 49 (1999), 255–66.

[67] M. Livi-Bacci, *Population and Nutrition* (1991), 63–7; S. R. Johansson, 'Food for thought: rhetoric and reality in modern mortality history', *Historical Methods* 27 (1994), 113–14. For this reason alone, we cannot use evidence of differential mortality among whites and slaves in the mid-nineteenth century (as in, e.g., T. L. Savitt, *Medicine and Slavery* (1978), 141).

[68] e.g., H. S. Klein, *African Slavery in Latin America and the Caribbean* (1986), 159–60; R. W. Fogel, *Without Consent or Contract* (1989), 127–8; W. Dusinberre, *Them Dark Days* (1996), 410–16 (rice swamps).

[69] R. Sallares, *Malaria and Rome* (2002), 247–55.

[70] From B. W. Higman, 'The slave populations of the British Caribbean: some nineteenth-century variations' (1976), reprinted in H. Beckles and V. Shepherd (eds), *Caribbean Slave Society and Economy* (1991), 226–7. Group 1 consists of the Bahamas, Barbados, Montserrat, St Cristopher, Antigua, Nevis, and the Virgin Islands; Group 2, of Trinidad, Demerara, Berbice, and St Vincent; Group 3, of Jamaica and Dominica. Numbers in parentheses rank the variables in each rubric in terms of their advantageousness for natural growth (where 1 = best). CBR = annual births per 1,000; CDR = annual deaths per 1,000.

This simple matrix shows that death rates are the principal modifier: they predict growth rates in all cases, as opposed to only one case where sex ratio and birth rates predict growth. Ecological conditions and the age structure of the population emerge as the main determinants of reproductive success. Since the latter, together with the sex ratio, would even out over time, the disease regime may be regarded as the most stable determinant of natural growth.

Family Structure

As is well known, patterns of family formation and manumission can be of considerable importance in determining reproductive success among slaves. For instance, nuclear families, which are conducive to natural growth, were common in the US and the Bahamas (which experienced rapid natural growth) but rare in Trinidad and Jamaica (which witnessed ongoing losses).[71] This creates a serious problem for ancient historians who have no way of telling how many Roman slaves lived in stable relationships.[72] Epitaphs or legal texts are unusable because they merely confirm that *some* slaves had families. Even the Egyptian census returns offer only indirect evidence. Bagnall and Frier have found that the average fertility of slave women was similar to that of all women.[73] Thus, since overall fertility must have sustained the existing population, slave fertility ought to have been sufficient to ensure reproduction at replacement level. Yet we cannot know how this compares to conditions in Roman Italy. At the very least, epigraphic commemorations leave no doubt that, in some circles, fecund women were manumitted in significant numbers. I do not want to waste space by reiterating my earlier discussion of probable manumission rates in the Roman Empire. Suffice it to say that even on the assumption of substantial manumission across the adult life cycle, this practice would not greatly have reduced fertility *within* slavery.[74] Owing to the concentration of female reproductive capacity in the late teens and the twenties, a large percentage of all slave women would have had to be manumitted at those ages in order to make a large dent in overall slave fertility. Given the complete absence of any such habit in Roman Egypt, it would seem brazen to posit the exact opposite for Roman Italy. Reported slave prices suggest that the considerable monetary value of slaves must have been disconducive to the habitual manumission of youthful slaves.[75]

To sum up: servile sex ratios probably did not greatly interfere with natural reproduction. Above-average mortality in cities and rural *gravia loca* would have imposed more serious constraints on slave fertility. Female manumission, however limited in scope, must also have contributed to this trend. What we now need is a plausible mean average rate of attrition.

III. MODELLING ROMAN SLAVERY

I start with a simple and surely uncontroversial premise: that at the time of Augustus, slaves were much more numerous in Italy than they had been two centuries earlier. Brunt

[71] Fogel, op. cit. (n. 68), 150. For further references, see Scheidel, op. cit. (n. 60), 169.

[72] I note in passing that sexual exploitation of female slaves by owners was a ubiquitous feature throughout history. Because of racism and absenteeism, the experience of American plantation slavery is a poor indicator of the substantial demographic impact of this habit in more traditional urban and household-based slave systems. For Roman chattel slavery as a functional equivalent of harem polygyny, see W. Scheidel, 'Sex and empire: a Darwinian perspective', in I. Morris and W. Scheidel (eds), *The Dynamics of Ancient Empires* (forthcoming), with ample references.

[73] Bagnall and Frier, op. cit. (n. 18), 158.

[74] Scheidel, op. cit. (n. 60), 160–1, 165–7.

[75] I will discuss this more fully in Scheidel, 'Real slave prices and the relative cost of slave labor in the Greco-Roman world', *AncSoc* 35 (2005). See also Duncan-Jones, op. cit. (n. 28), 348–50; J. Straus, *L'achat et la vente des esclaves dans l'Égypte romaine* (2004), 296–8.

proffers a random guess of 500,000 slaves in 225 B.C. A hypothetical mean share of 7 per cent for Roman Egypt outside Alexandria,[76] were it applied to Italy, would yield 300,000 slaves in addition to a free population of four million, whereas a reduction of Brunt's guess by 60 per cent (to reflect the difference between his and my final totals) gives us 200,000. I see no way to improve on these guesses. Fortunately, the starting figure does not matter much: due to the scale of subsequent growth, and given a notional target figure of 1.2 million, a difference between 200,000 and 300,000 slaves in 225 B.C. would change the volume of intervening growth by not more than 10 per cent. The introduction of something like a million slaves over 200 years cannot have occurred at a steady rate: aside from fluctuations in supply and demand, inflows must have gradually increased over time. The following model accounts for this by positing steady annual net increments. Due to the growing need to compensate for attrition, this assumption is consistent with rising imports overall.

In my earlier discussion of Roman slave demography, I failed to allow for the effect of urban excess mortality on natural reproduction. I now agree with Jongman that his estimates of an annual shortfall of 1 per cent in Rome and of 0.5 per cent in the other Italian cities should be applied to urban slaves as well.[77] An intermediate average of 0.75 per cent, or 7.5 per 1,000, will work for all urban slaves combined. Attrition from manumission is more difficult to assess. In a hypothetical scenario in which 10 per cent of all slaves were manumitted at age twenty-five, 10 per cent of the remainder still alive were freed at age thirty, and so on every five years up to age eighty-five, overall slave fertility (assuming a natural fertility regime) would have been one-eighth lower than in the complete absence of manumission (for an annual deficit of 5 per 1,000). Quinquennial manumission rates of 20 per cent would lower fertility by one-quarter (for an annual deficit of 10 per 1,000).[78] In the first case, one-third of all slaves surviving to age twenty-five would eventually have lived to receive freedom; 55 per cent, in the other. If we rather crudely combined the effects of urban excess mortality and manumission, the urban slave population would on average have contracted by between 1.25 and 1.75 per cent p.a. At those rates, it would halve every fifty-five and forty years, respectively.

It merits attention that these rates compare very poorly with corresponding figures for Caribbean slave populations. Rates of natural decrease in that region were considered high: yet Higman's tabulation of 205 annual data from fifteen different islands produces an overall mean of merely -4.19 per 1,000, or a deficit of 0.419 per cent p.a. This is not more than a third to a quarter of my estimates for urban slaves in Italy. Only 9 per cent of the annual data from six of these fifteen Caribbean locations indicate a shortfall of 1.25 per cent or higher. Even in what is by far the worst sample, from Grenada in the years from 1820 to 1832, when annual death rates could rise as high as 50 per 1,000, the average annual rate of loss does not exceed 1.75 per cent. The sample with the highest sex ratio (123), from Trinidad, yields a corresponding rate of 1 per cent p.a. I must repeat that these data originate from a high-attrition environment: they are a far cry from contemporaneous rates of natural *increase* of 2 to 3 per cent p.a. in the southern United States. To my mind, the burden of proof rests with anyone who wishes to maintain that Roman losses *must* have been significantly higher than on the worst Caribbean slave plantations.

For computational purposes, I will put annual decrease in the cities at 1.75 per cent to allow for urban excess mortality and frequent manumission. We can only guess at the likely extent of disease-induced excess mortality in the countryside. If one-tenth/one-sixth/one-third of rural slaves had laboured in malarial terrain and experienced annual excess mortality of 1 per cent, the overall rate of attrition among rural slaves would have

[76] W. Scheidel, Review of R. S. Bagnall, B. W. Frier and I. C. Rutherford, *The Census Register P.Oxy 984*, *BASP* 38 (2001), 149 n. 2.

[77] Jongman, op. cit. (n. 14), 118; cf. Scheidel, op. cit. (n. 60), 166 (where the typo of '0.5 per 1,000' for 5 per 1,000 did not affect the calculation).

[78] This is based on my intermediate and high manumission schedules, op. cit. (n. 60), 160, 166. I have rounded the numbers.

been 0.1/0.17/0.33 per cent p.a. This remains a fairly negligible quantity regardless of our choice of estimate. If we assume a lower incidence of manumission in the countryside (for an annual deficit of 0.5 per cent), total losses may have amounted to 0.6 to 0.8 per cent p.a. I use 0.7 per cent as a computational mean.

As I have argued above, it does not seem likely that the age or sex distribution of the slave trade or the resultant slave population was very heavily skewed in favour of adult males. Nevertheless, it is inherently desirable to devise an estimate of the probable volume of slave imports that does not depend on the acceptance of any particular assumptions about demographic structure. For this purpose, I offer two hypothetical schedules that represent limiting cases. Schedule 1 is based on the wildly implausible notion that Italians imported only male slaves aged fifteen to fifty. In the absence of other attrition factors, this population would have shrunk by 3.85 per cent (of the initial cohort) per year. In conjunction with the rates of excess mortality and manumission estimated above, total annual losses would rise to around 5 per cent. The final size of this slave population is derived from my estimates of the probable number of full workers required in various sectors.[79] Conversely, Schedule 2 envisions a fully balanced age and sex distribution among Italian slaves; excess mortality and manumission are the only causes of attrition. Assuming that adult slave women would on average perform half as much work as adult men, this population features two-thirds as many fifteen- to fifty-year old men as Schedule 1 but 2⅔ times as many slaves overall (Table 2).[80]

TABLE 2: HYPOTHETICAL SCHEDULES OF ITALIAN SLAVE DEMOGRAPHY, 200–1 B.C.

	Adult males only	Balanced
Initial size	50–100,000	130–270,000
Final size:		
Rural	120–300,000	320–800,000
Urban	200–400,000	530–1,060,000
Total	320–700,000	850–1,860,000
Net gain	270–600,000	720–1,590,000
Annual decrease (%):		
Rural	4.55	0.7
Urban	5.6	1.75
Shortfall	1,830–4,000,000	980–2,770,000
Total imports	2,100–4,600,000	1,700–4,360,000
Ratio imports/final size	1:6.6	1:2–2.3

Neither of these schedules is meant to approximate reality. Actual attrition rates, and therefore actual slave numbers, must have fallen in between these two extremes. For instance, my notional target total of 1.2 million slaves in Italy would be compatible with annual attrition rates of 1.5 per cent and 3.1 million imports, 2 per cent and 3.8 million imports, or 2.5 per cent and 4.5 million imports, for import/population ratios of 2.6–3.8:1. These theoretical constructs demonstrate that dramatically different age and sex distributions translate into similar transfer requirements: while a small slave population of adult men would have experienced high rates of attrition, a much larger and more balanced population could have performed the same amount of work whilst suffering from considerably less natural decrease. In other words, a smaller male-biased slave population

[79] I reckon with a minimum of 2.5 adult male domestic slaves per *decurio*, etc., plus 80,000 in sub-élite households; and a minimum of 20,000 adult men in the rural non-farming sector. The other figures should be self-explanatory.

[80] To allow for a gradual increase of imports over time, I schematically assume steady annual rates of net gain.

characterized by high productivity and high attrition and a larger and more balanced one with low productivity and low attrition would ultimately have required similar numbers of imports. I conclude that regardless of our assumptions about the demographic structure of Roman slavery in Italy, my estimates of overall relocation rates are necessarily fairly inelastic.

Except for Schedule 1, these estimates are strictly speaking concerned with the transfer of live births. However, on the theory that women and children were well represented in this movement, the actual number of imported slaves need not have greatly differed from these totals. A long-term average of 15–20,000 (for total imports of three to four million) is between two and three times the mean rate of wartime enslavement of 7,600 for the period from 217 to 167 B.C. that can be pieced together from literary sources.[81] (This sample includes the extraordinary total of 150,000 slaves from Epirus in 167 B.C.: without them, the mean drops to 4,700.) Given that average inflows in the first century B.C. would have been higher, my estimate leaves ample room for the 'civilian' slave trade.[82] My manumission schedules imply the presence of up to 200,000 freedmen in the cities and of another 100,000 or so in the countryside (although rural ex-slaves may have gravitated towards the cities).[83]

How do imports of three or four million over 200 years and an import/population ratio of around three to one compare to other slave systems? The southern United States, with four million slaves in 1860, and Brazil, with 1.5 million in the 1860s and 1870s, are the largest well-documented slave societies in history.[84] US slavery is commonly recognized as unique: after the official end of the Atlantic slave trade, the southern slave population more than trebled from 1,191,364 in 1810 to 3,953,760 in 1860. This final tally was the result of 600–650,000 initial imports. The case of Brazil may be of greater relevance. From 1550 to 1850, depending on one's choice of estimate, between 3.5 and 4.5 million African slaves were shipped to Brazil, yet its total slave population never exceeded 1.5 million at any given time.[85] The ratio of imports to population size of two or three to one broadly matches my range of estimates for Roman Italy. This need not be entirely coincidental. Brazilian slave society was known for relatively high rates of manumission in the cities and the successful integration of these ex-slaves. Cities and rural plantations were unhealthy.

I must emphasize that my bottom-up reconstruction owes nothing to the Brazilian evidence. Nevertheless, some measure of convergence would hardly be surprising, if only because it seems intrinsically implausible that the demography of Roman slavery should have been radically different from any other historical pattern. Rome was not Rio, and Italy was not Brazil. Nevertheless, as far as the practice and institutions of slavery are concerned, the Roman system resembled Brazil more closely than the United States.[86] At the very least, even if this parallel were to be considered unhelpful, we might derive some comfort from the fact that the transfer/population ratio suggested by my model is in fact

[81] Ziolkowski, op. cit. (n. 3), 74–5.

[82] Republican slave prices are unknown (cf. Scheidel, op. cit. (n. 75)) but must have been relatively low (i.e., compared to conditions in the mature empire): see my 'The comparative economics of slavery in the Greco-Roman world', in E. Dal Lago and C. Katsari (eds), *Slave Systems, Ancient and Modern* (forthcoming).

[83] See Scheidel, op. cit. (n. 1), 14–15. As I demonstrate, op. cit. (n. 60), 167–8, their average reproductive success *after manumission* must have been very low.

[84] Medieval Korea and the Sokoto Caliphate appear to have been endowed with comparable numbers of slaves but quantitative analysis remains hazardous.

[85] M. Karasch and R. E. Conrad in P. Finkelman and J. C. Miller (eds), *Macmillan Encyclopedia of World Slavery* 1 (1998), 116, 128.

[86] Comparative studies have usually focused on the US (references in W. Scheidel, *Phoenix* 50 (1996), 176 n. 5). Bradley, op. cit. (n. 12) emphasizes Brazilian comparanda. M. C. Karasch, *Slave Life in Rio de Janeiro 1808–1850* (1987) is particularly stimulating. I plan to discuss this issue in a future monograph tentatively entitled *Ancient Slavery and Modern Comparisons*.

attested for an actual major slave society, and therefore cannot be inherently implausible or impossible.[87]

What does this model tell us about the dynamics of slavery in Roman Italy after the first century B.C.? The only thing that is certain is that even a minute annual net shortfall would ultimately have reduced slave numbers to a great extent. Thus, an average net loss of 0.3 per cent p.a. (only a quarter of my above estimate) would have been enough to halve the Italian slave population within the first two centuries A.D., thereby either completely eradicating rural slavery or halving numbers in both cities and countryside. Although plantation slavery may well have contracted as exports subsided, neither of these options seems particularly compelling. An annual deficit of a mere 0.1 per cent overall could have cut rural slavery by one-third during the same period. These numbers indicate that if Italian slavery did in fact retreat, it must have done so because of declining demand rather than a shortage of supply. Even at a moderate annual gross rate of decrease of 1.5 per cent, the continuing presence of 1.2 million slaves would have demanded 18,000 imports each year. We cannot plausibly assume that Italian slave-owners were able to buy (say) 15,000 new slaves p.a. but would have found it impossible to obtain 18,000 if they had really wanted to. Arguments about supply have no place in discussions of the imperial slave system prior to the fifth century A.D.

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[87] cf. also P. Manning, 'Demography of slavery', in P. Demeny and G. McNicoll (eds), *Encyclopedia of Population* (2003), 895, for a 3:1 ratio (Indian Ocean region, nineteenth century).